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KANGERDLUGSUAK AND MOUNT FOREL: Two Journeys on the British Arctic Air Route Expedition: *A paper read at the Evening Meeting of the Society on 11 April 1932, by*

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IN a previous paper Mr. Watkins has dealt with the general work of the British Arctic Air Route Expedition to Greenland in 1930–31. From this it will have been seen that the chief scientific work of the expedition was meteorological and surveying. In this paper I am to describe two journeys: the coast journey in the *Quest*, and the sledging journey to Mount Forel, on which most of the survey work was done.

There are various opinions concerning the shape of the Ice Cap of Greenland, but I think it is agreed that between the latitudes 66° and 72° N. the maximum height of the Ice Cap is less than to the north or south of these latitudes. An air route would naturally take advantage of such a depression, and this was one of the factors which determined the position of our base, which was established near Angmagssalik, since any air-base would have to be in the locality of what native habitation there was. What mapping we did then, would have to be done in the region of Angmagssalik, and as far north as time would permit.

A map of the whole of the east coast exists; but this map is a compilation of charts of different sections of the coast, with a considerable interval of time between the completion of each section. The accuracy of the different sections varies considerably. As far as we were concerned we were dealing with maps made by only two of the long list of compilers. During the years 1883–85 Gustav Holm and W. Garde had completed the map of the east coast from Cape Farewell to latitude 66° 25′ N. With the report of this Konebaad Expedition there was included a sketch of the east coast from 66° to 68° 48′ N. drawn from information gathered from the natives. This is the first map to show the existence of Kangerdlugsuak. There was no accurate map of the coast between Angmagssalik and Scoresby Sound until the Carlsberg Fund Expedition in 1898–1900, the survey work being under the direction of G. C. Amdrup, assisted by Ejnar Mikkelsen. The longitudes of the coast north and south of Angmagssalik are referred to observations taken by Holm and Amdrup at Angmagssalik. The final map produced by Amdrup was purely a delineation

of the coast-line, with little detail inland, and frequently the heads of fjords were unmapped.

Considering the conditions under which it was accomplished it is an extraordinarily good map. What he drew in as definite was certainly accurate. Elsewhere, where he was unable to fix the detail accurately, although he could see it all, he merely indicated it with a broken line.

With such a map as a foundation, we made it our object on the coast journey to re-map the coast from Angmagssalik to Kangerdlugsuak, paying special attention to the uncertain parts of Amdrup's maps, and to try and get as good an idea of the interior as possible. For the latter purpose we hoped to take oblique air photographs of the whole coast. At first we intended leaving the base on August 10 and forcing our way up through the pack-ice as quickly as possible, to our most northerly point. On this outward journey the aeroplane was to have taken photos of the coast, which we were to use in the survey on the return journey. The *Quest* was to stay with the party until September 1, then return home, leaving the survey party in an 18-foot whale-boat with an outboard engine. The aeroplane was to fly back as soon as the photography was completed. But plans were considerably altered later.

We chose the site for our base on July 27, and by August 10 all our stores had been taken ashore, the hut assembled, and things were sufficiently settled for work to begin. On the morning of August 11 Scott's party began their journey inland to establish the Ice Cap station; Lemon was left alone at the base, and the rest of us, eight in all, left for Angmagssalik in the *Quest*, manned by her Norwegian crew. We were delayed here by fog, but the time was well spent in trying to persuade one of the more intelligent natives to accompany us as a pilot. The following day we began our journey north, with our native pilot on board, and a considerable number of native passengers. We kept inside the islands to begin with, dropping our passengers and their kayaks at the various settlements. We came out to the open sea by Leif's Island in latitude 65° 53′ N., close to which we left our first depot of food and fuel for the use of the returning survey party. It soon became obvious that the aeroplane could not take off from the sea and that we should have to find a clear fjord to fly from; and for this reason we went into Kangerdlugsuatsiak instead of pushing on northwards. We were able to get right up to the head of this fjord, and as there was a certain amount of time to spare we began our survey, whilst others, accompanied by our pilot, went in search of Greenland's only fruit—a small berry, remarkably like the bilberry of Westmoreland. The weather at this time of the year was very pleasant, the temperature usually being just above 40° F. The days were very long and we were able to survey until 9.30 at night. The aeroplane succeeded in getting off in the evening, but nearly came to grief in landing, for during its absence the ice had begun to drift into the fjord again, and the amount of open water was far less than when it took off. This impressed upon us all the more the necessity of finding an ice-free fjord from which to fly and take the photographs we required.

The aeroplane, which was a Gipsy Moth, was carried on the deck in front of the bridge. When the wings were folded back there was just room for it between the hatch and the bridge. Even then however the tail projected over the side, and great care had to be taken when passing any large piece of ice.

Lowering the machine over the side was at any time a somewhat precarious business, owing to the erratic nature of the winch; but in a swell it required the assistance of everybody on board to prevent any damage to the machine.

D'Aeth and Watkins had gone up on this flight, and they had discovered that there was fairly open water the whole way to Kangerdlugsuak (the visibility in these regions being amazingly good) and no big fields of pack-ice obstructed our passage. Judging from previous reports this state of affairs was most unusual, and indeed a second flight was necessary before our dubious Captain would believe it. Throughout the whole summer we were extremely fortunate in the condition of the ice, and most conversations with Captain Schjelderup concluded with the refrain, "Never in my life have I seen so little ice."

During this flight D'Aeth had also seen a fjord a little farther north, at the head of which was a lake, which appeared to be suitable for a flying base. So it was decided that the next day the *Quest* should make for this fjord and if the lake proved suitable, stay there until the photography was completed. With this delay in view we decided to continue our survey up to this fjord from the *Quest*. The next morning proved to be one of the only two wet days we had on the whole journey.

Surveying in fjords and bays was very much easier than along the actual coast-line. In a fjord we could cross from side to side and so get good intersections of the detail, the distances being controlled from a base measured with a range-finder. On the coast however intersections were difficult where there were no bays or islands. In this case the survey consisted of a plane-table traverse, the distances again being measured with a Barr and Stroud 30-inch base artillery range-finder. We continued our survey by these methods from Kangerdlugsuatsiak into the fjord known afterwards as Lake Fjord. The lake, which had been seen from the air, proved entirely satisfactory. It was about a mile inland from the head of the fjord, and was about 2 miles long and $\frac{3}{4}$ mile wide.

There was no glacier entering this fjord, and the country at its head was low and uneven, through which a stream found its way from the lake. With the help of the ship's crew petrol was carried up from the ship to the lake. The *Quest* remained in Lake Fjord for five days, during which time the aeroplane took off quite safely from the lake, and with D'Aeth piloting the machine Watkins was able to take photographs of about 150 miles of coast-line. These were obliques taken at 10,000 feet, and as no mechanical charge was used, Watkins was kept very busy during the flight. When it was decided to stay in the fjord for four or five days our Eskimo pilot, who had forgotten to bring his sleeping-bag (at least, that was the excuse), decided to go back and fetch it in his kayak. This was on August 17; no more was heard of him, either by us or by his family, until September 12, when he arrived back home. Where he had been in the meantime nobody found out.

While the *Quest* remained in Lake Fjord, Courtauld, Chapman, Wager, and myself set off in the whale-boat to continue our survey. We took with us two small alpine tents and a box of sledging rations, arranging for the *Quest* to pick us up at Cape Gustav Holm, some miles farther north. On this journey we had a certain amount of trouble with the ice. We had to pass in front of the two big Steenstrup glaciers which come down into the sea just north of Lake Fjord.

Just before we reached this part a considerable amount of ice must have broken off from the glaciers, for the sea was absolutely thick with small broken bits of ice, forcing us to take in the motor and row. The ice suddenly seemed to collect all around us, and very soon there was as much ice behind us as in front, so we had to row on into it, trusting that we would be clear of it before night, when it would freeze into a solid field. We frequently got into such conditions, and we had to row for more than half the distance we travelled. Another difficulty we had when travelling in the whale-boat was the task of finding a suitable mooring place each night. The swell on these steep rocky coasts is so great that the boat must be tied fore and aft to prevent its being battered to pieces against the rock. This meant that each night we had to find a suitable small cove across which the boat could be tied. Unfortunately such a cove rarely coincided with a nearby piece of ground flat enough to pitch two small tents on. Usually after securing the boat we had to climb 100 feet or so up the side of the hill until we found a suitable camp site. The latter term in this country implies a piece of rock sufficiently flat and large for four people to sleep on, without the fear of rolling off during the night and finishing up in the fjord.

Even at this time of the year there was fresh ice at the heads of the fjords, and we had to begin the day by rowing through thin ice. However, on the fourth day after leaving the *Quest* we reached Cape Gustav Holm. We had seen the aeroplane up two or three times, and had concluded that the photography ought to be finished, and the *Quest* should pick us up that night. At 2 a.m. we were awakened by the ship's siren, and replied by firing two or three shots to give the crew an indication of our whereabouts. Before leaving the place we left another depot of food and fuel.

From Cape Gustav Holm we decided to go straight to Kangerdlugsuak. This fjord, although known to exist from Amdrup's surveys, had never been entered by white men. Its size was unknown, but it was believed to be large, judging from the width of its mouth. Usually the ice conditions are bad about this part of the coast, and several ships have been lost in the area. As we approached the mouth of the fjord a swell got up very suddenly, so suddenly in fact that most of us were entirely unaware of the almost complete disappearance of the ice. In the early hours of the morning however the Captain very proudly announced that we were actually right at the mouth of the fjord, having had no difficulty with ice. After seeing the first view of this magnificent fjord from the top of the hill at the mouth we decided to go straight to the head of it and start the survey from there, whilst the *Quest* searched around for a suitable stretch of water from which the aeroplane could take off in safety.

By noon on August 24 we had reached the end of this fjord, which proved to be about 35 miles long. There were various tributary fjords entering it, and many glaciers flowing down into the water. These smaller glaciers however were all surpassed by the magnificent outlet glacier at the head, flowing from the Ice Cap itself. This glacier, where it enters the mountain belt, is about 6 miles wide, gradually narrowing to 3 miles at sea-level, where it continues for 2 miles into the fjord as a floating tongue. Close to this, the shore was low and flat, so it was decided to make a big dump of food and fuel here, enough to last a small party two or three months. It was hoped, then, that a sledging

party would be able to come to Kangerdlugsuak by the Ice Cap in spring, and make use of this depot. Whilst the depot was being laid, a base was measured with the range-finder, and the survey of the fjord begun. Numerous tracks were found in the loose sand between the boulders, tracks of ice bears, wolves, and foxes. It was surprising to find tracks of bears and wolves in so low a latitude at that time of the year—but the isolation of the fjord from fur hunters explained it. Although no white man had ever entered this fjord before, it had been the site of native habitation. All the way up the coast and also in this fjord we found frequent remains of houses and burial places. The disappearance of the Greenlanders from these outlying areas must be accounted for by the establishment of the Danish Settlement at Angmagssalik and to the gradual decrease in the numbers of seals. The latter decrease must be attributed in part to the ruthless way in which the seals are hunted for skins.

On August 25 the *Quest* left the survey party at 4 a.m. and steamed out to the mouth of the fjord, hoping to take advantage of what promised to be a fine day for photography. As the ice was too thick for the whale-boat to start, an azimuth observation was taken.

Once the *Quest* had gone the loneliness of the fjord became more apparent, and seals began to come up all around us. Just before noon we saw our first polar bear, and after rowing after it and cornering it in a bay in an iceberg, Chapman shot it. Later on in the day we had to shoot another, which became too interested in our affairs to be safe.

The progress of the survey was held up slightly on the second day, since the part to be mapped was a steep-sided blunt promontory, and we were never able to see more than a quarter of a mile ahead from a position on the promontory. This meant we had to do a slow and tedious traverse around the point. Usually the most convenient landmarks in such an area were the glaciers. On one occasion when we landed close to a glacier a large piece of ice broke off from its snout and fell with a roar into the water. A few seconds later the resultant wave took our boat from its moorings and set it rocking. A second such wave caught the boat when it was tilted and filled it to the brim with water. Fortunately we had taken most of the instruments on shore with us, but all our kit and cameras were soaked with salt water.

We reached the mouth of the fjord by the evening of the 28th, and were picked up by the *Quest*. Unfortunately, during the time that we had been mapping the fjord the people on the *Quest* had been unable to find any suitable stretch of water to fly from, and they had now decided to go out to sea and get clear of the ice. So after arranging to meet us in four days' time, the *Quest* once more left us.

This time Wager joined us again, for while Courtauld, Chapman, and I had been mapping the main fjord, Wager had been doing his geology from the *Quest*. We discovered later that the *Quest* did not go out to sea as the ice was 25 miles thick, and that they flew from Mikis Fjord about 8 miles north of Kangerdlugsuak.

While flying from Mikis Fjord Watkins and D'Aeth obtained a photograph of the country north of Kangerdlugsuak which revealed a very high range of snow-covered mountains. The range was about 60 miles inland, and judging from the height of the surrounding mountains, must have been about 12,000

feet. Unfortunately this photo was taken on their last flight before returning to the base, and no further information of these new mountains was obtained.

In the meantime we proceeded to map the very much indented region around the mouth of the fjord—rowing all the way, since the motor had ceased to function. Actually we rowed practically the whole length of Kangerdlugsuak owing to the unsuitable ice conditions which would have ruined our outboard engine had we used it. On September 1 we completed the mouth of the fjord and were ready to start south with the *Quest*. The previous night we had experienced a very strong wind, one of us having to get up and re-pitch the tent. This wind coincided with the first big wind which they had at the base. Whilst waiting for the *Quest* we chased two more bears, this time chiefly to obtain photographs, much to the annoyance of our Norwegian Captain, who was amazed that we should have been within 20 yards of two bears for so long and not killed them.

Surveying from the *Quest* was more laborious than from the whale-boat. The ship was forced to travel during all the hours in which it was light enough to see, and consequently we were forced to work during the same time. This meant getting up at 2.30 a.m. and working, at first, until 8.30 p.m.; but fortunately this was reduced by an hour or so before we finished the journey. Immediately south of Kangerdlugsuak the ice conditions were bad. In this region the coast-line consists almost entirely of glaciers, interspersed with nunataks. Amdrup marked the Ice Cap as coming down to the sea here; but this is not the case. Inland there is a belt of mountains, up to 40 miles wide, but very heavily glaciated, and only the tops of the mountains jut through. The sea off this part of the coast is invariably full of bergs and glacier ice, and is the scene of the loss of more than one sealing ship.

Unfortunately, just as we reached this area we were held up by fog, and the Captain was determined not to stay there, so we left the coast and went out to sea, returning a little distance to the south. Thus we were forced to leave a gap in the survey. Farther south we were fortunate in being able to continue the survey from a series of islands. The whole of this part of the coast is very deceptive, for the islands are snow covered and fairly low, making it very difficult to distinguish between the islands and the mainland. This is even more so the case when the sea between is a solid field of ice merging imperceptibly into the gently sloping glaciers of the mainland. Presumably it was owing to such a state of affairs that Amdrup marked quite a number of islands as part of the mainland. These deception islands were often noticed from the crow's nest. The most interesting of these discoveries however was made in studying the air photographs, from which we discovered that Kruuse's fjord came out to sea again farther south, thus forming another new island.

On September 6 bad weather caused us to take shelter behind Kialinek Island. Amdrup had kept outside these islands, so the mainland was uncharted, and we would have liked to have had more time at our disposal. We could have left the *Quest* here, and continued the surveying from the whale-boat, at our own time, as previously planned; but the ice conditions we had met with were not favourable to such a course. The *Quest* had found great difficulty in getting to land, at all the places we wished to work from, and it is certain that the whale-boat would never have got through. Thus, although we might have

Surveyors at South Steenstrup Glacier

"Quest" in Kangerdlugsuatsiak

New range of mountains north of Kangerdlugsuak, 60 miles inland

Air-photographs, 10,000 ft. H. G. W.

Coast and Flat Island, 50 miles south of Kangerdlugsuak

had more time to spare in certain places, had we continued the journey in the whale-boat, we should have had to leave out certain areas completely owing to their inaccessibility. So we decided to complete the journey in the *Quest*.

While sheltering behind Kialinek we got into wireless communication with the base, and learnt that Watkins and D'Aeth, who had left us at Kangerdlugsuak in the aeroplane, had arrived back safely, and that Scott, Rymill, and Bingham had got back from the Ice Cap, having established the centre station.

South of Kialinek Island we were able to travel more quickly, as we had surveyed some of the coast on the way up. As we approached the islands north of Angmagssalik the mapping became more hectic. There are innumerable islands off the coast, and we often had to land ten or twelve times a day. The nights were getting longer by now, but we could still start work at 3.30 a.m. and go on until 7.30 p.m. Whoever was on watch at 3 a.m. would wake us up and row us ashore to whatever part we wanted to go, and he would come back for us at an arranged time. The *Quest* would then move on, and get as close to our next point as possible, when one of the crew would again take us ashore. The difficulty of mooring the boat was so great that we always had a member of the crew to take the boat back to the ship, or to wait in the boat. A perfect landing required a great deal of practice. The bow of the boat was pointed at the particular piece of rock we wanted to land on, then as the boat was hurled towards this point, on the swell, one man leapt ashore, and the boat rushed out to sea again. This was repeated for each man who wished to land.

It was impossible to map the tangled mass of islands around Angmagssalik in the time at our disposal. Gustav Holm's map had been improved by the native schoolmaster, and we could not improve on this in the available time, so we completed our survey by mapping the outside islands down as far as Cape Dan. When we reached the cape there was not a piece of ice in sight over the stretch of water which six weeks before we had taken three days to penetrate.

We reached the base at 9 a.m. on September 14, spending until noon unloading our stores and equipment from the *Quest*. The afternoon and evening were spent in carrying loads over the rock barrier on to the glacier, for the use of Watkins's Ice Cap party which was to start on the 15th. Early the next morning, within less than twenty-four hours of completing the coast journey, the survey party found themselves on the glacier acting as a supporting party to Watkins, Scott, Bingham, and D'Aeth. This lasted for four days, and it was not until the 18th that we considered the coast journey as over and began to make plans for the winter.

We hoped to map the inland side of the coastal mountains in the following spring. During the autumn we intended to map the land around the base, and in the winter to survey the coast to south, from the pack-ice. We decided that the best way to do the coast close to the base was to take three natives and go in one of their umiaks. So in the last week in September Courtauld, Wager, and I set off in an umiak to continue our survey to the south. Unfortunately at the mouth of the fjord there was a big swell, which lasted for a week, and owing to the nature of our craft the owner refused to carry on. This swell was accompanied by a fog, so we returned to the base early in October. In the short time that was left before we began the October journey up to the Ice Cap station we mapped the base fjord on a scale of 1 inch to the mile.

After returning from the Ice Cap towards the end of November, arrangements were made for the winter survey of the coast from the pack-ice, hoping that the pack would be land-fast by then. Unfortunately this was not the case, and not only was there land water in December, but it persisted throughout the whole winter, and not once was the pack close enough in to the land for sledging on the pack to be feasible. For this reason the southern survey was postponed until the summer.

February was spent in making preparations for the inland journey to Kangerdlugsuak, for which six people hoped to start on March 1. This party planned to go north, mapping the coastal belt of mountains from the inside as far as Kangerdlugsuak. They were to stay in this region for a month, doing survey and geological work, and then return in May or June. Before this party left the base however things occurred which caused considerable alterations.

It was thought that only two people—Scott and Riley—with two sledges would be sufficient to go up and relieve Courtauld. Scott soon discovered that the surface of the ice was much worse than we anticipated in March and that one of his sledges was not strong enough for the rough surface. He also decided that three men and three sledges ought to go up instead of two. So the Kangerdlugsuak party had to give up one of their men and two of their sledges. The necessity of having two people at work repairing the aeroplanes robbed us of another man. Finally it was decided that Wager, Chapman, and myself should go on the northern journey, taking two sledges. We left the base on March 12, but instead of getting to Kangerdlugsuak we found ourselves back at the base on April 11. During the thirty days we were away we had only been able to travel on fourteen of them. Overloaded sledges, deep snow, very bad visibility, bad crevasses, and blizzards had all combined to make us turn back after getting only 90 miles from the base on a proposed journey of 320 miles. Twice during this journey we had to lie up for five consecutive days. It was this same spell of bad weather that made Scott's task of finding Courtauld quite impossible.

After Scott had got back Watkins, Chapman, and Rymill went up to relieve Courtauld, again taking one of the sledges we intended using on our next journey north. By the time we had repaired another sledge there was obviously not time to get to Kangerdlugsuak and back in safety, so we decided to go north as far as Mount Forel and do some survey and geology in this region. This time Bingham was to come with us instead of Chapman.

All four journeys which left the base between March and May were delayed in starting owing to fog and low cloud. The reason for this was that during the winter we had taken most of the man food, dog food, and fuel for the summer journeys up to the Big Flag depot about 12 miles inland and clear of the crevasses. Owing to the tortuous course which had to be taken to reach this depot it was extremely difficult to find, and quite impossible in foggy weather. So each party had to wait for a clear day on which to start.

May 6 turned out a fine day, and we decided to start. That afternoon, as we were approaching the Big Flag depot, Ahrenberg flew over us on his first trip into the Ice Cap. The next morning the plane flew over us as we were loading our sledges, and about three hours later we saw it returning. They passed over us and dropped a message from which we learnt that Watkins's party had been

seen and that there were four of them—all walking. From the fact that all four were walking we gathered that Courtauld was quite fit, and we continued our journey not a little relieved.

Mount Forel, our objective, was first seen by De Quervain when he crossed the Ice Cap from west to east in 1912. He took theodolite observations to it every day as he came down to the east coast and estimated its height at about 11,000 feet; but the nearest he got to the mountain was 70 miles. Forel can be seen from a long way inland, and was at times visible from the Ice Cap station, when refracted up. It is not an impressive mountain, being almost flat topped and snow covered. As seen from the route to the centre station it appeared to rise straight up from the Ice Cap in a gentle dome. The general opinion was that climbing to the top would present no difficulty whatsoever, but judging from the state of the Ice Cap close to the mountains at the base, it was supposed that we should have great difficulty in getting through the crevasses to the mountain itself. Our journey in March had taught us that we could not take a direct course to the mountain. From the head of Sermilik Fjord a big valley runs into the Ice Cap, the sides of which abound in tremendous crevasses. To avoid this valley, which crossed the direct route to Forel, we had to travel in a north-westerly direction to begin with and then true north until well clear of the valley. This took us up beyond the latitude of Forel, and our final approach to the mountain was from a little north of west. The Ice Cap in this region consists of a series of valleys and ridges rising slowly northwards to a height of over 9000 feet. This high region seems to coincide with the subsidiary dome which Lauge Koch assumed to exist in this part of the Ice Cap.

The inland side of the mountains around Forel is bordered by a wide glacier flowing in a south-westerly direction, the ice-cap boundary of which is marked by a series of nunataks. Around these the inland ice falls in steep crevassed slopes, but the intervening valleys are smooth and free from crevasses, affording easy access to the glacier.

The mountain side of the glacier is fed by many tributaries which drained the area we hoped to explore. One of these tributary glaciers led straight to the foot of Forel and appeared to be free from crevasses.

This, then, was our obvious route, and to our astonishment we were able to sledge across the big glacier and up the tributary to Forel, without crossing a single crevasse. We passed through this gateway to Forel on the sixteenth day after leaving the base, having travelled on thirteen days and covered a distance of 176 miles. Apart from the three days when we had to lie up the weather had been warm and sunny, but the surface was soft, and we had to wear snowshoes every single day—excepting the man who went ahead on skis. Skis were undoubtedly the best method of travelling, but the surface was still considerably cut up with wind-drifts, and it is impossible to manipulate dogs and a sledge over such a surface when wearing skis.

From the time that we had turned our course eastwards the aspect of Forel had changed daily, and during the last few days of the journey we concluded that the only feasible approach to the summit was from the south-west. The summit is an ice dome which everywhere caps a rock wall of about 1600 feet, rising up from the almost flat glacier below. Where the rock rises steeply the ice dome ends abruptly in an overhanging wall of 200 or 300 feet. But above the

easier south-west ridge the edge of the ice dome was less steep. This ridge ran up from a snow col between Forel and an adjoining mountain which we called Camp Mountain. On our first arrival we went straight to the west side of the col, but from here the ridge which we proposed to climb appeared to be more accessible from the east of the col; so we sledged round to the south of Camp Mountain to investigate the approach from the east. But on this side of Forel we discovered a hollow 3000 feet deep, encircled by mountains rising precipitously from the glacier below. Beyond this were many fine peaks and glaciers, the latter draining into a glacier 8 or 9 miles wide, running south-east into the head of Sermilik Fjord. From this immense system of glaciers we were cut off by a very steep rock wall of 3000 feet. This difference of level between two glacier systems so close together was most unexpected, and we had to return to the western approach.

Camp was pitched within a quarter of a mile of the foot of the col at a height of 8800 feet. The next morning, leaving Bingham in the camp to look after the dogs, Wager and I set off at 6 a.m. for a reconnaissance of the col. Progress was slow as the snow was from 12 to 18 inches deep, and the slope up to the col fairly steep. There were two bergschrunds to be crossed before we could get to the top, the first of which presented no difficulty as there was a firm snow bridge. The upper lip of the second, which extended to the top of the col, proved difficult. It was snow-free ice and at a slope of 75°. The angle of slope was so steep that in order to cut a step 6 inches wide the back wall of the step had to be 2 feet high. This took a long time, and we did not reach the ridge of the col, 700 feet above the camp, until 10 a.m. The other side of the col was a smooth ice slope which narrowed rapidly and fell steeply down a couloir to the glacier some 3000 feet below, which we had looked down upon from the southern end of Camp Mountain on the previous day. To get to our ridge we had to cross this steep ice slope. Steps were difficult to cut, and Wager who was leading had to return once or twice to rest before we reached the foot of the rock ridge about 60 yards away, two hours later. We then spent an hour on the rock, looking for the best way up, before returning to camp.

The next day we were prevented from pursuing our attack on Forel by drifting snow and signs of a strong wind. We therefore sledged across to a mountain we called Little Forel, owing to its close resemblance to Mount Forel, and climbed it, hoping to do some surveying from the top. Unfortunately, when we left the base, we did not think that we should be able to travel about in the mountains with such ease, nor did we expect to have so much time to spend in the region of Forel. For these reasons our survey equipment consisted only of a theodolite, hypsometer, and aneroids, and no plane-tabling equipment. So I decided to take as many rounds of horizontal angles as I could, plot them on paper, and fill in the detail as on a plane table. We took a $3\frac{1}{4}$-inch micrometer theodolite to the top of Little Forel, and between the periods of mist and drift we measured angles to all the prominent points. The following day was also unsuitable for climbing Forel, so we measured a base on the glacier by making a ski-track as straight as possible and then driving the dogs up and down the track four or five times. The reading of the sledge wheel was taken at the end of the first and last runs and a mean value taken. The dogs will always keep rigidly to a previously made track in any unknown

Bears at Kangerdlugsuak

Getting ashore through closely packed blocks of glacier ice

Mount Forel

country. We then took rounds of angles from both ends of the base and from the camp.

On the third day after our first attempt on Forel the weather was good enough to try again. We left camp at 5 a.m., and the steps being cut we were able to reach the foot of the ridge by 6.15. The first 200 feet of the ridge consisted of rotten rock, and we had to go up either the gulleys or the arêtes between them. Above this was steep but good rock, which meant climbing up a steep ridge by pitches of 60 or 80 feet at a time. We then came to patches of snow and rock, the snow being treacherous, but fortunately only once was it necessary for both of us to be on it at the same time. Beyond these patches of snow the rock was rotten again, and great care had to be taken in selecting a route. The rock itself is a gabbro, rusty brown on its weathered side. Frequently as we climbed up our eyes were attracted to small vivid patches of green, red,or yellow lichens,sheltering in niches of the rock. Apart from these lichens there was no sign of any vegetation or life whatsoever.

We reached the top of the rock after six hours' climbing, but the ice dome, which from below had appeared to slope down gently, was much steeper than we expected. It came to an end at the top of a steep pitch of rock, and we had little room in which to experiment. I belayed to the rock and Wager cut steps diagonally across the slope for one rope's length; but the ice was of such a texture that instead of being able to cut a step with five or six strokes of the axe, it took twenty or thirty. To get to the top of the steep part, about three hundred steps would have been necessary, a task which required more time and energy than was available in such a small party. It would have been unsatisfactory for a tired man to attempt cutting these steps, as a miss hit would have meant a loss of balance, and an accompanying drop of 4000 feet. We decided therefore that it was unwise for us to carry on. Before starting our descent we boiled the hypsometer and read the aneroids, from which we subsequently found our height as 1600 feet above the camp, which, after a week's observations, was determined as 8800 feet. Thus we had reached a height of 10,400 feet; 800 feet higher than the summit of Petermann Peak, until then the highest point reached in the Arctic.

We took about five hours to descend, reaching camp by 7 p.m. Before we left this camp site we spent another day climbing ice domes and nunataks in the area, for surveying and geological purposes. We then moved camp and sledged round to the north end of Forel, hoping to find a way to the summit from the north-east. On the way we were surprised to see a bird flying overhead. It was very high, about 2000 feet above us, and even from that distance it appeared to be quite large. We came to the conclusion that it was a Greenland Falcon, though we could not be sure. We only saw one other bird on this journey, and that was when we were climbing Little Forel. It darted past us at great speed, and looked very much like a snow-bunting, though again we could not be certain. The approach from the north-east was no easier than from the south, and we had not the time to spend two or three days on what might prove to be a fruitless investigation. From here we went north-west for two days and climbed a nunatak on the inland side of the big glacier. From the top of this, at a height of 10,500 feet, we had an excellent view of the mountains to the north which form a wide belt stretching inland for 90 miles

from the coast. This mass of mountains to the north lies in a region which existing maps portray as ice-cap, with no mountains. There are many peaks and high ranges comparing favourably in height with Forel, and one which we named De Quervain's Peak is a possible rival to it. We cannot be certain as it was too far away to fix accurately by an intersection. The height of Forel was determined as 11,100 feet, by theodolite observations based on original heights by the aneroid and hypsometer. Throughout the week we were there the aneroid was very steady, and a similar steadiness prevailed at the base during the same time. This should prevent any outstanding error occurring in our estimates owing to local disturbances.

On May 30 we turned our course southwards, hoping to make a rapid journey home with our light sledges. But no matter how much we decreased our weight we were still unable to ride on our sledges. The surface was still soft and frequently wet, which made travelling very difficult. Twice we travelled by night, but the newly frozen crust on the snow was not strong enough to take the weight of the dogs, and in addition to travelling in soft snow they had to endure the most tiring of all ice-cap troubles, that of continually breaking through the surface just when you think it is going to hold you. To avoid this latter trouble we decided to travel by day and plod on in the slush. However, in spite of having to wear snowshoes every day on the way home, we reached the base after twelve days' travelling, averaging 16 miles a day.

We stopped two or three times on the way back to take horizontal angles to the more prominent of the peaks that could be seen to the east. The difficulty of intersecting points by this method is to determine the position from which the angles were taken. We took latitude observations and obtained our position on the parallel of latitude by rays from peaks which we knew to be fixed. In a mass of mountains such as this it is very difficult to pick out the same peak from two places 30 miles apart, especially if in the meantime you have been travelling in low cloud, or falling snow. Nevertheless we were able to obtain an idea of the distance to which the coastal mountains extended inland. We tried to continue this inland survey to the south a fortnight later, when we started on the Ivigtut journey. Here however the difficulty was to see the mountains at all, owing to the sudden steep fall of the Ice Cap down to the coast. To have kept the mountains in view would have meant travelling in crevassed regions all day, which was impracticable at the beginning of such a long journey owing to our limited food supply.

The final survey work of the expedition was done on Watkins's boat journey to Julianehaab. They continued the coastal survey from the base down to Umivik, Lemon doing the plane-tabling and Courtauld the astronomical work. Altogether the expedition mapped 350 miles of coast-line and obtained an approximate idea of the inside border of the mountains for 150 miles.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: Fellows will remember that we were promised a second lecture giving a further description of the activities of the British Arctic Air Route Expedition to Greenland organized and led by Mr. Watkins. To-night we are to have a description of two journeys: the coast journey undertaken in August 1930, and the attempt

on Mount Forel in May 1931. I say attempt because the two who went on that journey failed by 500 feet to reach the actual summit of the mountain. That in no way detracts from their performance, which was a very remarkable one indeed. No human being had ever before been within 70 miles of Mount Forel; De Quervain sighted it and named it Forel after his compatriot, a distinguished Swiss geographer who had died the year before De Quervain made his journey in Greenland. Both these expeditions were led by our lecturer, Mr. Stephenson. On the first journey he had as his companions Mr. Courtauld, Mr. Chapman, Mr. Wager, Mr. Hampton; and Mr. Watkins himself, the leader of the main expedition, was not far off. In the attempt on the ascent of Mount Forel Mr. Stephenson took with him Mr. Wager and Dr. Bingham.

Mr. Stephenson was at school at Norwich and he then read and graduated in geography at St. Catharine's College, Cambridge, so recently as 1930. So that he has not had very much time to do a great deal of other work. This was his first expedition and he will describe it to us in a lecture I now ask him to begin.

Mr. Stephenson then read the paper printed above, and a discussion followed.

The PRESIDENT: Mr. Watkins is here to-night; we should like to hear a word or two from him.

Mr. H. G. WATKINS: I do not really think I have anything I can add to what Mr. Stephenson has already said. Having heard his lecture, you can realize that I had a very easy time as leader of the expedition. You have heard the account of two journeys undertaken very successfully by Stephenson and other members of the expedition. Apart from those, there were five other journeys, all equally successfully undertaken. In fact, I really had nothing to do but sit at the base and say a journey had better be done from the base to some other place, and however difficult the journey or however unpleasant the weather, there was always somebody ready to undertake the journey. In short, there never was any lack of volunteers. If I had suggested a journey from our base to Timbuctoo, somebody would have undertaken it happily.

The PRESIDENT: Professor Debenham has been, I will not say a father to the expedition, but a sort of uncle. I will ask him to address us.

Professor DEBENHAM: I think we should be very grateful to the Council of the Royal Geographical Society for their particularly happy idea that there should not be one, and that a very official, paper about the British Arctic Air Route Expedition, but two papers, which should be, so far as possible, complementary. The first, which many of you must have heard, was by the leader, Mr. Watkins. It was a big enough task to cover a long expedition, with a large number of subsidiary journeys, in a lecture which had to be rather formal. I am sure we have been very much interested in being able to hear from Mr. Stephenson to-night what we may perhaps call the lighter side, and certain details about parts of the expedition that Mr. Watkins could not possibly discuss in the time.

Mr. Stephenson has given some information about the manner in which the surveying was done: the words slipped off his tongue very readily. He suffered under my hands in learning surveying. I fear some of the distinguished surveyors in the hall this evening will feel somewhat disappointed with the method that had to be adopted, especially as I do not remember Mr. Stephenson giving the mileage of the coast-line nor the actual amount of time spent on it. He was good enough to say I suggested part of the method. It was a suggestion of despair, for I was asked to say how something like 500 miles of coast-line could be surveyed in ten or fifteen days! No ordinary surveying methods could cope with that. The maps, when finally published in the *Geographical Journal*, will, I think, show that the method adopted has met with a measure of success, though it will not bear comparison with regular surveys.

Mr. Stephenson gave me one great surprise, and I dare say many others in the room were also surprised. It makes one feel ashamed to realize that twenty years ago explorers were always hungry on 30 ozs. a day; yet here are these young men saying that 20 ozs. a day is a great deal too much. It has been a great delight to me to hear Mr. Stephenson's lectures, though I had, naturally, heard a good deal of it before. Those of you who are not so fortunate as to be in touch with members of the expedition will, I am sure, be grateful to Mr. Stephenson for what he has been able to tell us.

The PRESIDENT: The more one hears of the British Arctic Air Route Expedition the more important it appears to become. I look forward with eagerness, as I am sure all interested in Polar work of any kind do, to the book which is being compiled, and which, I hope, will shortly be produced. In that book, no doubt, those details which Professor Debenham has suggested he would like to have heard more of, and which I and many others would like to hear more of—tides, distances, temperatures, and all the various things which are of such intense interest in all travel, and particularly in Polar travel—will be found.

There are certain points that occur to me which are of great interest to this Society and to all of us. One of those points crops up very often, and that is the great use which can be made of the air in survey work, and how we shall gradually come to a combination of air survey, ground survey, and, for hydrographical work, ship survey and soundings. I was talking of it only a few days ago to Sir Wilfred Grenfell—and after all Greenland and Labrador are not so far apart. I have tried to impress upon those responsible for surveys of Labrador what an immense use can be made of a combination of air survey and ship survey. I know that there is one who has much to do with the Admiralty here this evening, and I hope that those words will not fall on unheeding ears.

I would particularly congratulate you, Mr. Stephenson, on that admirable map of Mount Forel and its surrounding peaks. Considering the short time available for its making and the difficulties, the result is very accurate and descriptive. The naming of the various places is of great importance. Take Mount Forel to start with: nothing could be more admirable than the name you have given to the way up, Forel Gates; but when it comes to other places, such as North and South Camp, I hope Mr. Watkins, in finally settling names with, perhaps, the Danish Government, will pay great attention to having these points and mountains very definitely named. Mr. Stephenson mentioned an Eskimo name—I will not attempt to pronounce it, for that is one of the languages I do not speak—and I hope that steps will be taken to choose some name which can be translated into the language of the country. With reference to what Professor Debenham said with regard to the greediness of his generation—heaven knows what mine must have been!—I think it is possible that the quality of the food has improved as a result of what has been learned from those who went in Professor Debenham's time; those who pack the foods have learned to concentrate a great deal into a small quantity.

My business here to-night is to thank the lecturer for his work and his lecture. I can assure you, Mr. Stephenson, that I do that on behalf of this company and of the Society with the greatest possible sincerity. We all know that Mr. Stephenson is going next month on the Second International Polar Year Expedition. He will be away for about a year and a half in the northern part of the centre of Canada. While he is there he may be sure that he will carry with him the good wishes of the members of this Society, and receive a very warm welcome when he returns to speak to us, as easily and, may I say, as modestly as he has this evening, about his experiences in Canada.

THE WEATHER ON A GREENLAND AIR ROUTE: *A paper read at the Afternoon Meeting of the Society on 18 April 1932, by*

S. T. A. MIRRLEES

THE importance of Greenland as a stage on the great-circle route between this country and North America and the consequent need for an extension of our knowledge of its climate are doubtless sufficiently well known to this Society to need little further emphasis here.

Since a full discussion of the meteorological work of the B.A.A.R.E. will necessarily require a considerable amount of time, it has been thought well to give a brief preliminary account, devoted chiefly to showing in what way the meteorological observations made by the expedition have added to what was previously known of the climate of Greenland. This previous knowledge was based (*a*) on observations at fixed coastal stations, both the set of stations maintained by the Danish Meteorological Service over periods of several years, and the base stations of various expeditions for short periods; and (*b*) on observations made during various journeys on the Ice Cap, almost entirely during the summer months of the northern hemisphere.

The material handed over to the Meteorological Office for discussion comprises the following:

(*a*) Observations at the base station, lat. 65° 38′ N., long. 38° 39′ W., at the head of a small fjord, some 30 miles west of the Danish observing station at Angmagssalik, covering a period of very nearly a year from 5 August 1930 to 25 July 1931. The observation hours were 9h., 13h., and 21h. Local Mean Time.

(*b*) Observations at the Ice Cap station, lat. 67° 3′ N., long. 41° 49′ W., about 140 miles north-west of the base, covering a period of about eight months from 8 September 1930 to 26 April 1931 (during the latter part of the period the observations being less complete). The observations were made every three hours from 7h. to 22h. L.M.T. (of base station).

(*c*) Observations on a number of sledge journeys on the Ice Cap and on a sea trip in the coastal region, also observations of temperature during several seaplane flights.

Base station.—Considering first (*a*) we get a picture of weather which differs from that at Angmagssalik in some respects, apparently depending entirely on the different exposures of the two places.

For example, Angmagssalik has on the average forty-five days with fog in the year, summer being the most foggy season with from seven to nine days of fog in each of the months from May to August. At the base, on the other hand, fog over the station was relatively rare in summer (only four days from May to August), and more frequent in winter (nine days between November and February). The coastal fogs of summer often penetrated some distance up the fjord however, and were visible from the station as isolated patches of sea fog. The enclosed situation of the base restricted the selection of suitable objects for the observation of visibility. The most distant fixed object was at $6\frac{3}{4}$ miles, just beyond the conventional range for "good visibility," and was visible at no fewer than 60 per cent. of the observation hours.

There can be no doubt that on many occasions the visibility was recorded as 6¾ miles when the air was sufficiently clear for objects at a much greater distance to be distinguished. During a seaplane flight on 18 August 1930 it was estimated that at a height of 10,000 feet the visibility was 180 miles. Lowered visibility was apparently associated mostly with precipitation, rain in the warmer months, driving snow in the colder months.

The observations of wind at the base show a fairly definite seasonal variation. In summer light south-easterly winds predominate, in winter northerly winds are the most common. In both seasons the percentage of calms is high, particularly so in winter, the percentage frequencies of observations of calms at the fixed hours of observation averaging 58 in the winter months and 47 in the summer months. If attention be confined to the observations at the fixed hours there are no records of gales in summer, though gales occurred in most of the winter months. Closer examination of the weather diaries however disclosed the occurrence of gales at all times of the year in the intervals between the fixed hours of observation. In all it was found that there had been forty-two days on which a gale (force 8 or above on the Beaufort Scale) occurred at some time in the twenty-four hours. Of these there were no fewer than seventeen days on which a gale was not recorded at any observation hour, and only seven on which a gale was recorded at all three observation hours.

The occurrence of these gales of short duration appears to be characteristic of the winds at the base station. Many of them were gales of great violence, force 12 (Beaufort) being reached on eleven days, force 11 on three, and force 10 on four; most of them were from a northerly point, but one was from south-east and one from south. Several of the northerly gales, which were accompanied by a rise of temperature, were evidently examples of the usual Föhn phenomenon of Greenland, but others apparently brought a fall in temperature, and this point requires further investigation. There was a fairly definite sequence of events in the northerly gales. At first clouds of drift-snow on the Ice Cap showed that the gale was blowing there; meanwhile gusts from a southerly point were felt at the base (presumably an example of the "Leeward-eddy" phenomenon); and presently the gale would strike the base with full force. The cessation of the gale was equally sudden; at times the gale could be seen to continue on the Ice Cap after it had ceased at the base. The barograph pen showed some remarkable movements during these gales (Fig. 1). Most of the gales which were not recorded at the observation hours occurred during the night or early morning, but one blew from 15.00 to 20.30. Northerly gales were usually associated with small cloudiness, those from other directions with much cloud and precipitation. The fact that in both January and February there were eleven days with gale at the base, whereas the normal frequency of gales at Angmagssalik during that period is one day per month, shows well how intensely localized are conditions in these Greenland fjords; the winds at the base attain greater velocity simply because they are constrained to blow in a narrower channel; as the channel broadens out the wind velocity correspondingly decreases.

The temperature observations call for little comment, the mean temperature for the various months being mostly within a degree or two of the corresponding normal values for Angmagssalik; the average temperature of the months

October to April was below freezing-point, the average temperature for the whole year 30°, and the highest and lowest recorded temperatures were 63° and −3° respectively. All temperatures are on the Fahrenheit scale.

Ice Cap station.—The unique nature of the observations from the Ice Cap station makes a more detailed examination desirable. Visibility, which is the

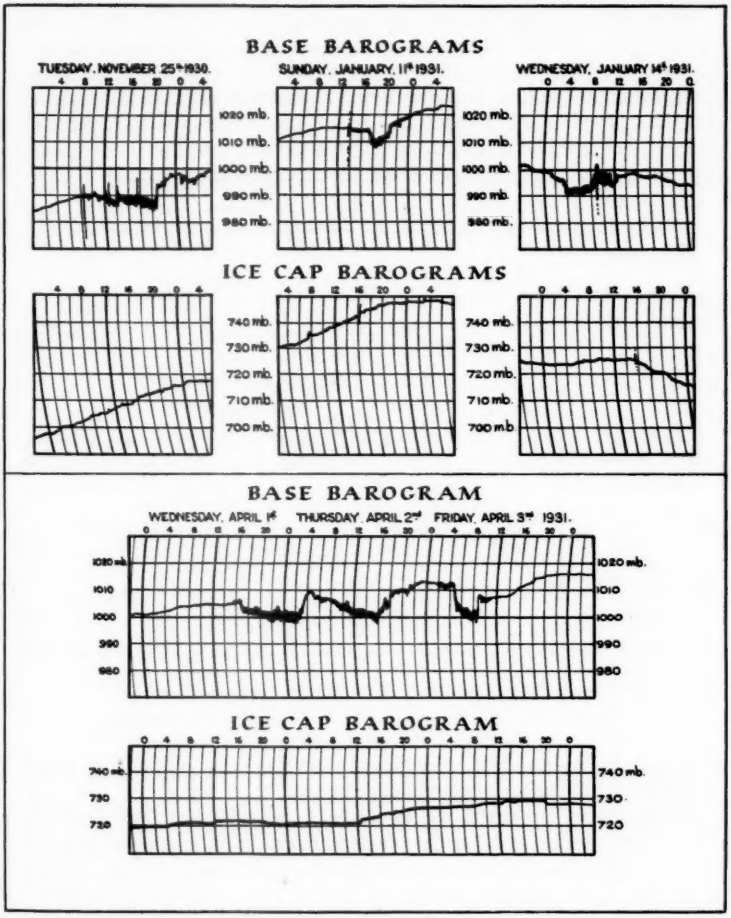


Fig. 1. Barograms showing gales at Base but not on Ice Cap

element of most concern for aviation, may be considered first. The lack of any prominent landmark and the difficulty of estimating distance on the ice surface make the observation of visibility on the Ice Cap by the standard method now adopted at meteorological stations one of some difficulty, and of a series of flags which were used for "objects" the most distant was 1½ miles away, correspond-

ing approximately with the limit for "poor visibility" on the scale adopted in this country. The frequency with which this object was visible decreased from 67 per cent. of the observations in the month of September to 1 per cent. in January, and in the period from November to February, both months inclusive, the visibility was less than half a mile at almost one observation in every two, actually a mean frequency of 44 per cent.

When all the available information regarding the cause of impaired visibility was collected, it appeared that of the figure of 44 per cent. mentioned above, 26 per cent. could be explained as due to drifting snow and 6 per cent. to precipitation at the time of observation. In many cases it could be observed that the drift-snow was a shallow layer and the zenith was clear. Actual fog was not frequent, having been noted at 9 per cent. of the observations in September and 3 per cent. in December: it is perhaps mainly a summer

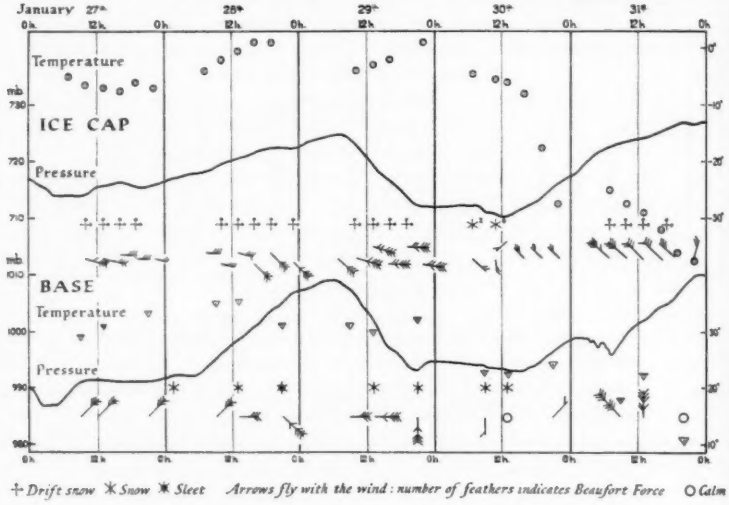


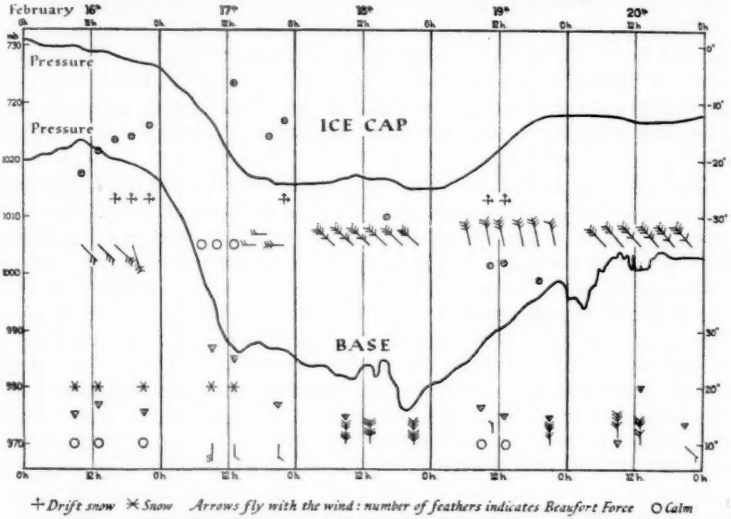
Fig. 2. Weather January 27–31: Winds mainly easterly

phenomenon, having been observed on several occasions during summer crossings of the Ice Cap by various expeditions.

These figures are based on all available observations, including many estimates of visibility at other than daylight hours, and the question arises how far the observations by day and estimates by night may fairly be combined. It may be noted therefore, that if the data for 13h. alone are considered, the frequencies of "fog" and "no fog" during the whole period September to February are 41 and 59 per cent. respectively, and in December, the month in which on the whole the daylight period is shortest, there were 48 per cent. of observations of "fog" to 52 per cent. of "no fog" at 13h.

The régime of winds at the Ice Cap station was entirely different from that at the base. During the whole period September to March winds from a northerly point prevailed, calms were very infrequent, and winds of force 4 to 7

considerably more frequent, but gales much less frequent, than at the base. During the period of simultaneous observations at the two stations there were thirty-three days with gale at the base, of which only seven were days with gale at both stations. There were only two days with gale at the Ice Cap station on which gales were not experienced at the base; these gales were from east and south-east. There was no preponderance of northerly gales, as at the base, four of the nine days having gales from between east and south. The highest wind force recorded was 9. The south-easterly gales brought snow and a rise in temperature, but the maximum temperature in January occurred with a south-west wind. The average temperature of the air varied from 2° in September to −33° in February, and the average minimum temperature from −9° in September to −43° in February. The highest temperature recorded was 29°, in September, and the lowest, −59°, in January and in February.



+ Drift snow × Snow Arrows fly with the wind: number of feathers indicates Beaufort Force ○ Calm

Fig. 3. Weather February 16–20: Winds mainly north-westerly

These figures may be compared with conditions at Verkhoiansk, in the cold pole of Siberia; here the average temperature of September is 36°, of January −58°, and a temperature of −80° may be expected to occur about every second winter.

Apart from a single day at the beginning of the month, temperatures at the Ice Cap station first began to fall to about the freezing-point of mercury (−38°) towards the end of October. The variation of temperature from day to day appears to be very large and depends to a large extent, if not entirely, on the direction and force of the wind; thus on December 6 and 8, with light northerly winds, temperature failed to rise above −45°, and on December 16 and 17, in a period of strong easterly winds, failed to fall below 2°.

It is of importance in connection with the determination of the height of the Ice Cap station to find what is the difference between the air temperatures at

the two stations, and accordingly the simultaneous observations at 13h. during the period November to March were examined. It was found that the average difference of air temperature was 44° F. The difference varies considerably under different conditions of wind and cloudiness; thus on days of much cloud at the Ice Cap station the average difference was 36°, on days of little cloud 49°, and on days of strong wind from between west and north at both stations, 53°. Estimation of the temperature in the free air is difficult on account of the well-known tendency in polar climates for the formation of inversions of the usual lapse of temperature near the surface, for example, on a November day on which the observation of mirage at the Ice Cap showed the presence of an "inversion" the difference in temperature between base and Ice Cap at 13h. reached 64°, while in the course of a flight over the Ice Cap on December 19 the temperature observed in the free air at a height equal to that of the Ice Cap station was some 30° higher than the temperature at the latter station.

Cloudiness at the Ice Cap station was small, averaging four-tenths of sky covered in the period September to February, and varying from about five-tenths in September to nearly three-tenths in February. The higher forms of cloud appear to predominate, especially in the colder months, and with the prevailing northerly winds; with winds from other quarters the sky may be overcast with lower clouds.

The low temperatures, associated with surface pressure not much different from the normal for this country, result in high values of the air density; thus the density at the base in midsummer was about equal to the average for the year in south-east England, while the values at the Ice Cap station were approximately the same as the average values at 6000 feet above south-east England. Barographs were in operation at both stations, and the records show that there was a high correlation between the daily ranges of pressure at the two stations, but that the sudden changes of pressure of the type already mentioned were confined to the base and apparently associated with the sudden increases and decreases of wind during northerly gales; they did not occur during south-easterly gales. Winds of the extreme forces experienced during northerly gales might produce a diminution of pressure inside a building of the order of 3 to 5 mb. The greatest barometric range in a day (midnight to midnight) was at the Ice Cap station 24 mb., in November; ranges of 10 to 20 mb. were not uncommon in November and from January to April; at the base the greatest daily range was 34 mb. on the same day as that with 24 mb. at the Ice Cap; ranges in excess of 20 mb. occurred in each of the months from November to April. Considering rises or falls of pressure which continue at a more or less uniform rate for several hours, the rates of such changes did not usually exceed 2 to 3 mb. per hour at the base and 2 mb. per hour at the Ice Cap. The observations of barometric pressure have been used in the computation of the difference in height between the two stations. From consideration of various assumptions as to the appropriate value for the mean temperature of the air column it may be stated in round figures that the Ice Cap station is 2500 metres or 8200 feet above the level of the base station (which is itself about 50 feet above the fjord surface).

The detailed study of the weather changes at the two stations from day to day is not completed, but for the sake of illustrating some of the weather

experienced, two examples of weather types, one of easterly and one of westerly winds, have been chosen, and the sequence of weather at the stations for two periods of five days is shown on Figs. 2 and 3. These show the variations of pressure, temperature, wind direction and force, and the types of precipitation observed.

1. *The weather of the period January* 27–31.—In this period strong easterly winds occurred at both stations. At the Ice Cap station temperature was relatively high while air was being forced up from the sea, south-east of Greenland, but fell rapidly with the change of wind to north-west. The sequence of events can be followed on Fig. 2; the usual changes associated with the passage of a depression are evident. The synoptic charts of sea-level pressure in the

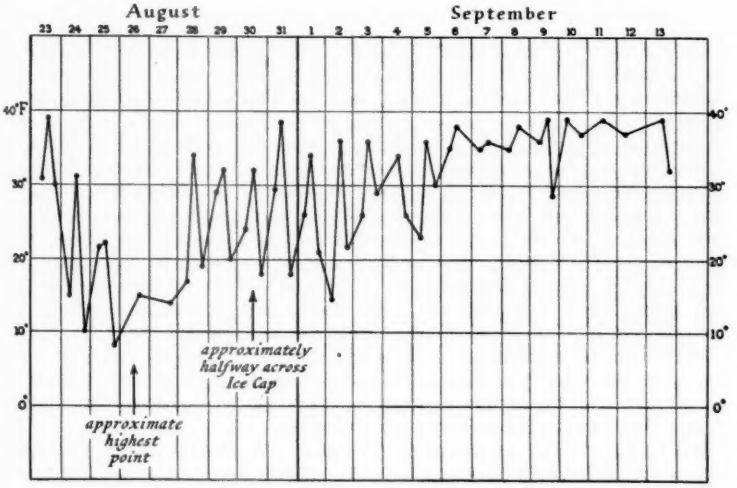


Fig. 4. Temperatures on Ice Cap journey to Holsteinsborg

Daily Weather Report show a small depression crossing Greenland between the 30th and 31st.

2. *The weather of the period February* 16–20.—Strong north-westerly or northerly winds were experienced during this period. The synoptic charts show a depression crossing Greenland on the 17th and 18th. Heavy snowfall occurred on the Ice Cap and the observer was snowed up on the 18th and 20th. At the base, the Stevenson screen was blown down by the gale on the morning of the 18th.

Figs. 2 and 3 show the changes of pressure and temperature in relation to the scales at the left- and right-hand sides respectively. The temperatures are shown as isolated points, the pressure by the continuous line, which does not attempt to show the more violent movements, but rather the mean value of the barograph traces at the moment.

As an example of the data obtained during the sledge journeys Fig. 4 shows temperature observations made during the journey across the Ice Cap from

Angmagssalik to Holsteinsborg. This diagram does not show so well-defined a central cold zone as appears in similar diagrams in the results of some previous expeditions.

Further investigation is proceeding.

A few figures from the Ice Cap station of the German expedition which was in operation at about the same time have recently been published,* and may be quoted as a matter of interest. At this station the average temperature of February, the coldest month, was −53°; and of August, the warmest month, 0°. The recorded extremes of temperature were 22° and −84°. The prevailing wind blew from between south and east, and the highest observed wind velocity was 40 m.p.h.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: I have remarked on previous occasions that it is possible that in the romance and adventure of Polar travel the scientific results are sometimes overlooked by the general public. They are not overlooked in this Society. We have heard two descriptions of various parts of the journeys made by the Watkins Expedition to Greenland, and this afternoon we are to have some account of the meteorological investigations which formed such a very large part of that expedition. Its name was the British Arctic Air Route Expedition, and it was for that reason—to investigate the possibilities of an air-route from this country to Canada—that they went. Mr. Watkins, who we hoped would be with us this afternoon, unfortunately entrusted himself to a motor car instead of to an aeroplane, and he has broken down in Shrewsbury. I see that he is represented by some of his companions, although he will not be here to speak for himself.

We are first to be addressed by Mr. Riley, who took the meteorological observations, and then Mr. Mirrlees, who has had all the stuff, if I may use so colloquial an expression, at his disposal and has put it into shape, will deliver the lecture which I hope will be followed by a full discussion.

Mr. Q. RILEY: The meteorological work of the British Arctic Air Route Expedition was carried out from 5 August 1930 to 25 July 1931, thus giving a full year, all but five days, for daily observations at the base. The instruments used were a barometer of the Kew Pattern type, a barograph, maximum and minimum thermometer, a dry bulb and, for some periods, a wet bulb thermometer. A Robinson Cup anemometer was also set up, but was blown away on 5 October 1930, in a strong gust of wind, narrowly missing the observer at the time, and recording a steady speed of 129 m.p.h. The gust which carried it away was a good deal stronger.

The exposure of the outdoor instruments was on a small promontory about 100 yards from the hut, some 70 feet above mean sea-level. The land sloped abruptly down to the fjord on three sides and gently down to the hut on the fourth. The nearest high land was about a mile away, so I think the exposure was about as good as practicable in a mountainous country. The objects used for visibility purposes were points of rock at various distances, which as objects of the conventional type are not satisfactory. The observer therefore had to use his intelligence as to whether, if an object such as a tree or a house had been there, he would at that time have been able to see it. As, generally speaking, one could see either very well or not at all, there was really very little reason for

*'Arktis,' Gotha, 1931, p. 110.

speculation as to the appropriate letter to place in the visibility column of the register.

The Inland Ice station was situated about 140 miles north-west of the base. Observations were kept up from 8 September 1930 to 26 April 1931. During five of those months, from December to April, the observations were under the sole care of Courtauld and were most efficiently carried out. The instruments at this station were an aneroid, as used in aircraft, a barograph, maximum and minimum thermometer, and dry bulb. A Robinson Cup anemometer was also taken, but was found of little value as it was impossible to prevent it freezing up. Wind was therefore estimated according to the Beaufort Scale. The screen was placed 50 yards from the tent, and from the nature of the inland ice there was no difficulty in finding an open space, but drift-snow, which often filled the screen, was a great handicap. The estimation of visibility was also a great difficulty as there are no objects at all. On dull overcast days it was impossible to distinguish the land from the sky. Flags at intervals of a quarter of a mile were used, but were not very satisfactory. Again the imagination of the observer had to be the deciding factor. On sledge and boat journeys pressure and temperature observations and general weather conditions were kept.

Two comb nephescopes and two Alhgrimn Obscura nephescopes were also taken to Greenland. The clouds however, neither at the base nor at the Inland Ice station, lent themselves to observation. The sky was either completely overcast, completely clear, or clouded with high clouds which are impracticable for this method of observation. Consequently, upper air work was impossible. We had no balloons.

Before sitting down I should like to take this opportunity of thanking Dr. Simpson for his interest and help from the beginning of the expedition and all through. Also Dr. Whipple, to whom I personally owe much. I trust they will find in the results obtained some return, at least, for their generous assistance.

Mr. Mirrlees then read the paper printed above, and a discussion followed.

Dr. H. R. MILL: I am looking on the paper from the point of view of a physical geographer and endeavouring, as far as I was able to follow the speaker, to piece together the data which throw light on the influence of the forms of the land or ice on the distribution of meteorological phenomena. The work in the field has been carried out admirably by the young observers who took part in the expedition, yet I could wish that the staff had included a professional meteorologist. The next best thing to a specialist on the spot is to have honest men without any prepossessions as to theories which they want to prove or to disprove, but who are willing to take trouble and risk in recording exactly what the instruments show, and to have these figures subjected to an expert at home like Mr. Mirrlees. Such observations, so discussed, are capable of giving us a great deal of most interesting and valuable information, and the essential point which I gathered was that the weather was extremely local and that the difference at one place and another must have been produced by differences in the localities themselves. That is to say, that the meteorology was dominated by the geography of the region. It was interesting to know that calms and strong winds were more frequent at the base station than on the Ice Cap, and I was particularly struck by the frequency of the winds of force 12 on the Beaufort Scale. I remember once asking the veteran Dr. Buchan, who was my master in meteorology, how I should record force 12, and he said: "If you succeeded in recording force 12 on the Beaufort Scale you have not experienced it, because Admiral Beaufort defined force 12 as a wind which no canvas can withstand, and a notebook is not likely to be more resistant." But there is no doubt that, judging from the analogy between the

Arctic and Antarctic, winds probably exceeding force 12 on the Beaufort Scale are at times experienced on the margins of the Ice Cap. I hope that it may be possible for Dr. Simpson to tell us something about the resemblance of those phenomena in the Arctic and Antarctic regions, especially as to whether in his opinion the observations bear out the somewhat bold theory of Professor Hobbs that those cold winds are effective in promoting the atmospheric circulation of the world, and so have something to do with the weather which gives most of us such continual occasion to grumble.

Dr. G. C. Simpson (Director, Meteorological Office): It must be borne in mind that these meteorological observations have been taken for two quite different purposes. In the first place, they were taken on behalf of aviation, so that we should know what the meteorological conditions are in connection with flying. The second purpose was to give us information on general meteorological problems.

With regard to the aviation side of the matter I am not competent to speak; on that there are others here who will probably speak after me. Therefore I say nothing more about aviation beyond that you cannot expect a paper such as we have had this afternoon to give you the kind of information which is required for aviation. For aviation you do not want a general description of the weather. What the aviator wants to know is exactly how often certain things happen; we have to form frequency tables of the different wind strengths, the different visibilities, and the amount of snow; and all those questions have to be worked out in such detail that they cannot be given this afternoon.

I remember that, speaking from this table, Mr. Watkins said, much to the amusement of a large audience, that before he had gone to Greenland he asked the Meteorological Office how many gales he was likely to have, and they told him there would be probably something like one a month. Then he proceeded to recount the large number of force 10 and force 12 gales which were actually experienced. I am rather glad to have the opportunity of saying something about that because what the Meteorological Office told Mr. Watkins was perfectly true. There has been a Meteorological Station at Angmagssalik for quite a long time. Their records are good and they show that there are surprisingly few real storms at Angmagssalik; but that is not necessarily so at the place, only a few miles away, where the base station was. And it was because there is that difference that we were so interested in the expedition. If we had known all the meteorological conditions over the ice of Greenland we should not have been interested in the results brought back by the party. Therefore, while our data were quite correct so far as they went, the expedition has shown us very much more which we suspected but did not know. Now we know.

Both your President and Dr. Mill have asked me to say a few words with regard to the general meteorological conditions. I therefore propose to spend a few minutes in telling you what are the chief meteorological problems in connection with Greenland. They are very important. Greenland, as you know, is a great dome of ice, 8000 to 10,000 feet high in the middle, and sloping down on each side to sea-level. Now a surface of ice is a very good radiator but a very bad conductor of heat. The consequence is that, during the winter especially, the surface of ice becomes extremely cold, and this cools the air over it, so that a layer of air forms which is much colder than it ought to be, and very much colder than the air is at the same height away from that surface. Now the cold air all over this dome becomes unstable and it runs off like water running down the side of a hill. It is the outflow of this unstable air which, running down the valleys, produces these very heavy winds of which we have heard but which are extremely local—very much like mountain torrents.

But there is one thing I want to mention which probably has not struck you. I said the air starts by being very cold. Therefore you would expect that when this cold torrent of air comes rushing down to sea-level it would be biting cold. As a matter of fact, it is not; if anything, it is a little warmer than the air at sea-level. That is because when air falls in the atmosphere it comes under higher and higher pressure; it is all the time being squeezed, and when air is squeezed its temperature rises. The rise of temperature is at the rate of about 5° F. for every 1000 feet that the air comes down the slope. Therefore coming down from 8000 feet to sea-level the air temperature may rise to something like 40° F. higher than it was when it left the plateau. This outflowing wind—katabatic wind, as Sir Napier Shaw has called it—is the cause of the local storms, and they are met with only on the edge of the ice, generally at the foot of a glacier or valley down which the air pours.

So far all meteorologists are in agreement, but now comes a matter of controversy. Certain meteorologists, in particular Professor Hobbs, consider that the ice dome over Greenland and the ice dome over the Antarctic are important factors in the general circulation of the atmosphere. They consider that these ice domes reaching high up into the atmosphere act as refrigerators, cooling the air of the upper atmosphere, which flows down the slopes as I have explained, and so acts as the driving force for the general circulation. Professor Hobbs goes even farther and suggests that it is these sudden outflows of air—"strophs" as he calls them—which give rise to the cyclonic depressions of the North Atlantic and the Antarctic Oceans. Other meteorologists consider that the ice domes of the Antarctic and Greenland are only incidental factors in the general circulation of the atmosphere which would be little affected if they were removed, and rather than the strophs being the cause of the depressions it is the passage of the depressions which gives rise to the strophs.

All these problems have got to be worked out, and I personally am extremely keen they should be. When the expedition came to me before it left for Greenland and asked me to help with regard to the meteorology I felt very doubtful whether an expedition which was going without any trained meteorologist could bring back useful observations, but I offered to help. Mr. Riley was sent to us and he went to Kew Observatory. I must say that he very quickly got the rudiments of observing, and I would like to congratulate him personally most sincerely on the way that he organized the meteorological observations during the expedition and for the amount of information he has brought back. Further, we have to thank Courtauld for the observations which were taken on the Ice Cap which, of course, are, if I may say so, the only things that really matter. Without those we should have had practically nothing of any interest. It is because I know these men have gone to so much trouble to get these observations, and not only trouble but some considerable risk, that I personally am extremely keen that every bit of knowledge shall be got out of them. I was therefore glad when Mr. Mirrlees undertook to examine the observations because he and Dr. Brook, with whom he is working, both know how to get information out of meteorological observations, if anybody does. I think the paper to which we have listened is quite a good earnest of what we are going to have in the much more technical report which will come later.

The PRESIDENT: Group-Captain Walser represents Air-Vice-Marshal Burnett this afternoon, and I will ask him to say something with regard to the actual flying. Before he speaks I should like to say what I think we want to know. What I want to know, at any rate, is "What is it you want to be able to guard against in flying?" If your compass is very good it appears to me that fog does not matter so much. Presumably what you have most to guard against is wind. How high

must one rise above the coasts to get into the comparatively moderate winds that appear to obtain on the Ice Cap? Is it the configuration of the land that makes the storms at the base so violent, frequent, and uncertain? If that is the case—and, after all, as Dr. Simpson has said, this is an air-route expedition—where are the landing-places going to be? Can they be at sea? Those are the questions to which we want an answer.

Group-Captain A. A. WALSER said that from the Air Ministry point of view an interesting report had been received from the leader of the flying section of the expedition, and he thought that it was a pity that no member connected with the actual flying was present that afternoon. Various points had been raised on which a certain amount of useful information could have been given.

Referring first of all to the President's question, he thought that one of the main difficulties experienced in Greenland was the fact that when operating from the fjords it was extremely difficult to find a stretch of clear and open water free from drift-ice. He pointed out that seaplane floats were very easily damaged if they encountered pieces of drifting ice either when alighting or taking off.

Referring secondly to the matter of taking off from the frozen surface of fjords, he pointed out that the ice formation was frequently very irregular and that it was difficult to find a piece of open, flat surface from which to operate.

It was discovered that certain inland lakes formed a very much more suitable base than the fjords themselves, as the troubles encountered by drift-ice in the summer time and the irregular surface in the winter time did not occur. The only difficulty in using these lakes was that in the autumn when the ice was beginning to break up and in the spring when the lakes were beginning to freeze over the conditions were such that for a period of about six weeks it would be impossible to fly. He pointed out however that the fjords would be unavailable for a much longer period.

Referring to the question of temperature from the flying point of view, he thought that on the whole the expedition experienced very little trouble. A certain amount of information had been gained in Canada where aircraft operated in very low temperatures. Here it was found necessary to keep engines heated when aircraft were on the ground. He thought that a type of engine cover was used, made of several thicknesses of canvas which enabled heated air from an ordinary blow-lamp to keep the engine warm by means of a large-diameter canvas pipe.

A minor difficulty had arisen owing to the effect of cold on indiarubber. The shock absorber of the undercarriage was composed of rubber acting in compression, and the resiliency of this rubber had been affected by the low temperature. He thought that on future occasions some form of steel spring would have to be used.

It had been found that the under-surface of the skis used in the winter time became quickly worn by the friction of rough ice, and he thought that it would be necessary on future occasions to adopt some form of metal covering.

What impressed him most in reading the report was the extraordinary way in which repairs had been carried out. Owing to various accidents, both seaplanes had been damaged at one time or another: one so seriously that when the account was read of the parts that had to be replaced it seemed almost incredible that it had been possible to effect the necessary repairs under the difficult circumstances. He thought that Mr. Hampton, who had been responsible for the repairs, was to be congratulated. It made him realize that necessity was the mother of invention. He had been told by somebody that afternoon that parts of the aircraft had been replaced with driftwood which had been bought from the inhabitants, and that the damaged fabric of the tailplane had been replaced with an ordinary

piece of shirting used by the natives. The fact that all the repairs had been carried out locally made him wonder whether the use of metal aircraft, which were now in general use in the Service, would be altogether desirable. Although such aircraft would be more desirable from some points of view, it would be very much more difficult to effect local repairs.

He thought that on future occasions it would certainly be necessary to transport some form of hangar or material from which a hangar could be built, because of the sudden gales which arose without any warning.

As regards the President's question in connection with the effect of gales high up, he said that there was very little data about flying at high altitudes over Arctic regions, but the experience of the pilots showed that the gales were very local in effect, and he thought that, provided one flew at a reasonable height, it would be possible to pass over these disturbances. That was a point about which more information was required before we could attempt to carry out an air route over Greenland.

The PRESIDENT: I hoped that Flight-Lieutenant D'Aeth, who was the Flying Officer of the Expedition, would have been present, but he could not come because he is flying to-night. He has however written a paper which I will ask Mr. Stephenson to read.

Mr. A. STEPHENSON then read the following for Flight-Lieut. D'AETH:

Weather Conditions in East Greenland as they apply to Flying.—Mr. Mirrlees's paper, though only a preliminary survey, gives an excellent idea of the general weather conditions that we experienced during the course of the British Arctic Air Route Expedition, and I should like to say briefly how these conditions apply to flying. To do this my remarks must obviously fall under three headings—summer flying, winter flying, and flying over the Ice Cap.

Summer Flying.—The greatest enemy of the aviator is bad visibility, whether due to precipitation or fog. Before leaving England I had been led to believe that fog was very prevalent on the east coast of Greenland, and was very anxious on that account. As you have already heard, we were not in fact worried by it at all. Mr. Mirrlees has already shown that fog at the base only occurred on one day for every seven to nine days at Angmagssalik, about 30 miles east of us, and close to the sea; and this, I think, accounts for all the reports of fog that come from the coast. At the head of the base fjord, as you have heard, we very seldom had bad visibility, though coastal fog was often visible at the mouth. I can go further and say that we very seldom flew without seeing fog over the pack-ice, though from 100 feet upwards the weather was absolutely clear. Previously all reports have been sent from ships in or close to the pack, or from shore stations close to the sea. We however based at the head of a fjord, and operating with seaplanes were able to see that the fog formed over the pack, and not the coast, and that it very seldom even reached the coast except at promontories. If a base were chosen at the head of a fjord some distance from the sea, I consider that the risk of fog would be almost entirely eliminated. As to visibility, Mr. Mirrlees has stated that it is good, and has mentioned the case of the visibility from one of our seaplanes on 18 August 1930. I would like to make it clear that this is no isolated case, and that visibility, except during precipitation, is almost always extremely good. On 31 August 1930 Watkins and I left Mikis Fjord, just east of Kangerdlugsuak, to fly to the base camp. From 4000 feet over Mikis Fjord Cape Dan was clearly visible, a distance of approximately 200 miles, and it was so clear that had there been anything to see beyond it I am confident that we could have seen it. From the base also, I frequently saw vaguely where the coast north of Kangerdlugsuak turned eastward. I should say that on normal fine days the visibility from a suitable height is always more than 100 miles, as on such days

a conical mountain just north of Umivik was always visible while flying over the base. There were very few days when the clouds were low enough to interfere with flying, and there was very little precipitation.

During the summer months when seaplane flying was possible there was seldom any wind above force 3, and there was a large percentage of calm days. Mr. Mirrlees stated that an examination of the weather diaries shows that there were gales during all months of the year. This may be so, as I was not at the base all the time, but during the summer period where I was flying, either at the base or up the coast, we had no wind above force 4 or so between early June and August 30. The first gale we experienced at the base was during the night of 30–31 August 1930, but this was not blowing farther up the coast where the *Quest* then was. The last gale at the base in 1931 occurred during the latter part of April.

Generally then it can be said that the weather conditions during the summer appear to be ideal for flying, owing to lack of fog, exceptional visibility, reasonable temperatures, and light winds.

Winter Flying.—Apart from the very short hours of daylight during mid-winter the same remarks apply to the visibility during the winter as during the summer. Precipitation is however slightly more frequent, and during the gales visibility is reduced almost to nil owing to drift-snow. On fine days the visibility is always exceptional, and the mountain north of Umivik, previously mentioned, is always visible. The only period when fog appears to be persistent is during the spring, when the sea-ice is breaking up, but this only lasts a few days.

The most serious feature of the winter weather was the large number of gales, eighteen of which reached or exceeded force 10, eleven of these being recorded as force 12. Now, as Mr. Mirrlees has said, the fact that there were far more gales at our base than at Angmagssalik, about 30 miles away, should prove that they are extremely local, and this was our opinion at the time. From the flying point of view the chief danger was that the barometer gave no warning of the approach of these gales, but we found that drift-snow and the roar of the wind on the glacier about 4 miles from the base became apparent from two to three hours before the wind reached us, the noise even waking us in plenty of time at night to let us lash things down securely. Apart from the lack of visibility caused by the drift-snow, the violence of the gales is such that even the largest type of aircraft could not fly during one of them. We have agreed however that they are extremely local, so I think that from the flying point of view this difficulty could be overcome. If two bases were selected, say, 80 miles apart, aircraft could be instructed to fly on a course midway between them, and could then be told by wireless to land at whichever had the most suitable conditions. I wonder if Mr. Mirrlees could give us any idea as to what height the gales would reach? It is my opinion, though not based on any observations, that the effect would not be felt very high and that it would be possible for aircraft flying over Greenland and not landing, to fly over them without difficulty.

It would therefore appear that the coast would be quite suitable for flying except for the gales, and that even this difficulty could be overcome as explained above. Proper organization, with two bases, wireless, and a competent meteorological staff would be essential, and I consider that any attempt to run an air route without such organization is doomed to failure.

The Ice Cap.—From the meteorological point of view the observations taken at the Ice Cap station are of the utmost value, but they are not of such importance to the aviator who has only to fly over, and not land on, it. Given aircraft that can climb to a suitable height, it will always be possible to fly over drifting snow or low fog.

Visibility on clear days is once again exceptional, and on one occasion, owing to refraction, Mount Forel was seen from the ground, a distance of over 100 miles. There was seldom much cloud and low cloud was even more infrequent. On the other hand, though the wind never exceeded force 9, and the gales were far less frequent than at the base, there was a lot more precipitation, especially during south and south-easterly winds. I think however that it might be possible to fly over these storms. Reduced visibility caused by drift-snow would not affect aircraft flying over it. As on the coast, the weather during the summer is far finer than that during the winter, and is usually fine and clear with very little wind.

The most interesting feature is the extreme inversion of temperature for the first 1000 feet to 1500 feet over the Ice Cap. Except for the months June, July, October, and November, flights were made over it every month, and yet the lowest temperature recorded on any of these flights was —14° F. It can only be regretted that we were unable to obtain simultaneous observations at the same place. From the purely flying point of view this inversion is useful in that it adds considerably to the comfort of the crew and adds to the efficient running of the engine.

To conclude I would say that, from the point of view of the weather, an air route over this part of Greenland and the Ice Cap would be entirely practicable during the summer, where conditions are as good as could be found anywhere in the world. Conditions during the winter present a much more serious problem, owing to the gales, but, as far as I can see at present, an air route could be run efficiently given the proper organization. Once more I would like to say I consider that if an attempt to run such a route is made without the necessary organization it is bound to fail, and the consequences to the crews would probably be serious, if not fatal.

The PRESIDENT: I have asked Mr. Stephenson if there is anything he would like to add and he says there is not. There is one thing that the discussion has shown without doubt, and that is that if we are to go on with this business of long-distance flying we have to make a great deal more investigation and research. As the credit should always go, in the first instance, to the pioneer, we shall all agree that the greatest possible credit must be given to Mr. Watkins and his companions for what they have done on the expedition.

As we are on the subject of flying—and that is what we are here to speak and think about—I do hope that every possible attention is being paid to all the instruments which have so much to do with flying, most especially the compass. That seems to me to be one of the most important of all things. You heard Mr. D'Aeth's suggestion: that they could get high above the falling snow. If there is falling snow and fog on the ground it means nothing can be seen. Therefore the compass is of the greatest possible importance.

Another reason why further investigation and research is necessary is that permission has to be obtained to have air routes over these areas, and it is not to be supposed that permission is likely to be given if there is constant danger of people coming to grief and expeditions being called for to go out and look for those who are lost.

I know I am only voicing the wishes of all present when I offer most grateful thanks, on your behalf, to Mr. Watkins and all his party who made the observations; to Mr. Mirrlees, who put them together so admirably and has showed us those very interesting synoptic charts depicting the wind and the temperature and conditions generally; also to Dr. Mill and Dr. Simpson for the admirable clarity with which they have put forward their views. We thank you very much indeed, Mr. Mirrlees, for a very interesting paper. Mr. Riley is now going to show a short film depicting the effect of a gale.

Note by Mr. L. C. W. Bonacina.

There is a dangerous tendency, in thinking of Greenland as a local centre of outflowing circulation, to overlook the fact that the Icelandic storm centre is only just outside, and that the local circulation has to adjust itself to what is going on around. The snowfall of Southern Greenland is known to be heavy, and the severity and persistence of the blizzards on the Ice Cap itself, as recently described by Mr. Watkins (*G.J.*, May 1932), points to the influence of the Icelandic cyclonic systems.

Professor Hobbs's mistake is in tacitly assuming that Greenland is the only source of cold air for the cyclonic activity of the Northern Hemisphere. Greenland is a mere topographical accident whose absence would modify, but could not radically change, the character of the circulation. In Antarctica the ice-plateau happens to be located symmetrically about the pole, a fact which intensifies the cold-air drainage that would in any case take place from the polar area, and has a good deal to do with the excessive storminess of the Southern Ocean.

THE SITE OF ALEXANDER'S PASSAGE OF THE HYDASPES AND THE BATTLE WITH POROS

SIR AUREL STEIN, K.C.I.E., F.B.A.

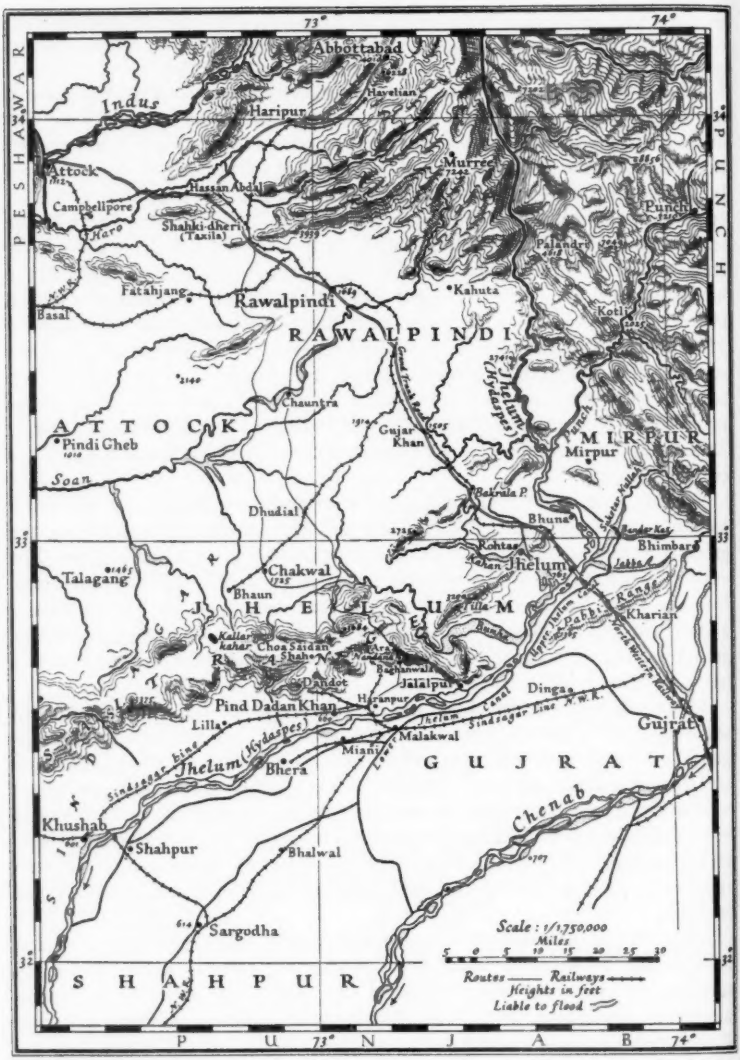
THE question of the ground where Alexander secured his bold passage of the Hydaspes and fought his great battle with Poros has been long discussed, but no definite solution has been reached and opinions have remained divided. This has been the result of conflicting locations having been proposed by those officers who in days long past had occasion to visit one portion or another of the ground where routes from the Indus crossing the Salt Range lead down to the Jhelum. Scholars working far away from India in their study could scarcely do more than try and weigh those opinions in the light of the interpretations they were led to put upon the records of Alexander's classical historians. Neither those early visitors to the ground since the days when Sir Mountstuart Elphinstone's famous Mission passed the Jhelum in 1809, nor the scholars discussing the proposed locations, had enjoyed the advantage of such accurate topographical and antiquarian information as the excellent maps produced in recent times by the Survey of India, and the records embodied by British administrators in District Gazetteers have placed at the disposal of the critical student.

Judging from what prolonged experience elsewhere had taught me, I felt convinced that even with the help thus afforded careful examination on the ground would be needed if a definite conclusion was to be arrived at. The opportunity for such an investigation had been desired by me for many years. But necessary freedom for it offered only last autumn while I was awaiting a start on the archaeological explorations in Southern Persia which the generous support accorded by Harvard University and the British Museum has now placed within reach for me.

There can be no doubt about the interest which for the historical student and even a wider public in the West attaches to this question of ancient topography. The scene of what was probably the most hazardous among the many amazing exploits of the great Macedonian's campaigns could claim more than romantic glamour if correctly located. For as a great strategist and student of history (Hellmuth von Moltke) has justly observed: "The locality is the surviving portion of reality of an event that has long ago passed by. . . . It often restores to clearness the picture which history has preserved in half-effaced outlines."

And certainly Alexander's passage of the Jhelum or Hydaspes when swollen in flood, and his subsequent decisive victory on the other bank over the vastly superior Indian army which opposed him, represent an event of lasting historical importance. It is true Alexander's victorious advance into the Punjab did not result in permanent conquest. But it was the first among the numerous successful invasions of India from the north-west frontier which history records, and by reason of the cultural influences for which it opened the door it marks an epoch in the past of India.

There is no need to discuss here the successive stages in that extraordinary campaign which had brought the Macedonian army across the Indus and



Country between the Indus, Jhelum, and Chenab: Rawalpindi Division

ultimately carried it victoriously to the bank of the Hyphasis or Beas where Alexander was obliged to give way before the war-weariness of the hard-tried troops and to acquiesce in the return westwards. Nor can I find room to set forth all the details presented by the extant records as regards the outstanding event which concerns us here. It must suffice to examine those briefly which may help to locate its scene. They are mainly to be gathered from Arrian. His account, derived to a great extent from contemporary sources, is the fullest and on the whole the most reliable.

Alexander, after his passage of the Indus, had been hospitably received at Taxila, whose ruler had before tendered his submission. There he learned of the opposition which Poros, the king of the region beyond the Hydaspes, the present Bihat or Jhelum, was preparing to offer to his advance into the Punjab. The mention of Taxila as the place whence Alexander's move to meet Poros was begun supplies us with an absolutely safe starting-point for his route.

The position of Taxila, the Takshasila of early Indian texts, was long ago correctly identified by General Alexander Cunningham with the ruined site of Shahki-dheri, between Hassan Abdal and Rawalpindi. Epigraphic finds and Sir John Marshall's brilliantly successful excavations have since placed this location beyond all doubt. The march thence to the Hydaspes must have taken Alexander across the Salt Range and the much broken tableland to the west of it. In many places the ground here offers difficulties to the progress of a large force. But there is no record of armed resistance having been met with until "Alexander encamped on the banks of the river and Poros was seen on the opposite side, with all his army and his array of elephants around him," as Arrian tells us.*

Alexander "clearly saw that it was impossible for him to cross where Poros himself encamped near the bank of the Hydaspes." Other points affording chances of a passage were also being carefully watched by detachments of the enemy. So he resorted to a series of demonstrations in different directions along the river bank to divert and wear out the Indian enemy's attention while he was trying to find a place where it would be possible for him unobserved to steal his passage across the river. It was the early summer when the waters of the river, swollen by the rains and the melting snows of the mountains, rendered fording impossible.

About the place which Alexander finally chose for the intended crossing, we are told by Arrian: "There was a headland (ἄκρα) ascending from the bank of the Hydaspes at a point where the river made a remarkable bend, and this was thickly covered with all kinds of trees. Over against it lay an island covered with jungle, an untrodden and solitary place. Perceiving that this island directly faced the headland, and that both places were wooded and adapted to screen his attempt to cross the river, he decided to take his army over this way. Now the headland and the island were 150 stadia distant from the great camp." Curtius's description of the place which Alexander selected for crossing states of the island that it was larger than the rest of the numerous islands in the river, and adds an important detail: "A deep ravine (*fossa praealta*) moreover, which

*McCrindle's translation in his 'Invasion of India by Alexander the Great,' 1897, is followed in the quotations from Arrian and Curtius, with needful modifications as suggested by the original text.

lay not far from the bank in his own occupation, was capable of hiding not only foot soldiers but also men with horses."

Arrian records at some length the dispositions made by Alexander to deceive the Indians as to his planned crossing. A portion of his forces under Krateros was left in the camp with orders to cross to the opposite bank as soon as Poros was seen to have withdrawn from it his formidable array of elephants; for these would have made it impossible for the horses unaccustomed to their sight to land. Another portion was posted between the island and the main camp and ordered to cross in detachments as soon as the Indian army were seen fairly engaged in battle. Alexander himself with selected troops of horse and foot "marched with secrecy, keeping at a considerable distance from the bank that he might not be seen to be moving towards the island and the headland from which he intended to cross over to the other side."

There skin rafts were carefully got ready during the night. There, too, most of the boats previously brought across from the Indus in sections had been conveyed and secretly pieced together. During the night a heavy storm came on, drowning the noise of the preparations with its thunder and rain. Towards daybreak the rain stopped and the troops moved across on rafts and boats in the direction of the island. "They were not seen by the sentries posted by Poros till they had passed beyond the island, and were not far from the bank." Alexander himself embarked on a thirty-oared galley with his bodyguards and other selected men. "As soon as the soldiers had passed beyond the island they steered for the bank, being now in full view of the enemy."

While the sentinels posted by Poros galloped off to carry the tidings, Alexander disembarked, himself the first, and at the head of the landed cavalry moved forward. "Owing however to ignorance of the locality he had unawares landed not on the mainland, but upon an island and that a great one . . . separated from the mainland by a branch of the river in which the water was shallow; but the violent storm of rain which had lasted the most of the night had so swollen the stream that the horsemen could not find the ford. When at last the ford was found, he led his men through it with difficulty."

There is no need for us to follow the details recorded by Arrian, mainly from the reliable account of Ptolemy, Alexander's general and the future king of Egypt, as to the events that followed the successful crossing. A brief summary of them including such points as may have a topographical bearing will suffice for our purpose. Alexander, leading forward his cavalry, some 5000 men, had no difficulty in routing the inferior force of horsemen and chariots which had been first sent ahead by Poros under his own son. The chariots proved useless in the action, having stuck in the clay, and were all captured. On learning of this rout and of the attack being launched by Alexander himself with the strongest division of his army, Poros decided to leave only a small force in camp to watch the troops of Krateros and to march against Alexander with all the rest of his army. He is said to have taken "all his cavalry, 4000 strong, all his chariots, 300 in number, 200 of his elephants, and 30,000 efficient infantry."

As regards the order of battle in which Poros drew up his army, we are given information which, as we shall see, affords a useful topographical indication. He "posted his elephants in the front line at intervals of at least a plethron

(101 feet)." Behind them he drew up his infantry in a second line. "He had also troops of infantry posted on the wings beyond the elephants, and on both sides of the infantry the cavalry had been drawn up, and in front of it the chariots." There is nothing stated that could suggest that this very extensive line of battle rested its flanks on any protective physical feature such as the river bank or higher ground might have afforded. It is important to note this point as it has its bearing on the tactical development of the battle and the light this throws on the topography of the ground where it was fought.

Alexander being superior in cavalry, opened the battle by attacking the cavalry on the enemy's left wing with the greater part of his horse. "The Indians meanwhile had collected their horsemen from every quarter and were riding forward to repulse Alexander's onset." Thereupon two regiments of cavalry under Koinos, whom Alexander had detached to his right, in accordance with his previous orders, appeared in their rear. The Indian cavalry thus forced to face both to front and rear was thrown into confusion, and completely broke when Alexander, instantly using his opportunity, fell upon it. Obviously the outflanking attack of Koinos was made possible only by the Indian left wing being at a distance from the river.

This initial success, gained as on other occasions by the trained skill of the Macedonian cavalry and the genius of its leader, decided the issue of the day. The elephants, to which the Indian horsemen had fled for shelter, on moving forward were met by the Macedonian phalanx which had come up. The latter, though unaccustomed to face elephants and suffering serious losses from their onslaughts, held fast. Alexander's cavalry, being free to operate from all sides, made great carnage wherever they fell upon the enemy's ranks, though the Indians fought very bravely. "The elephants being now cooped up within a narrow space, did no less damage to their friends than to their foes."

Finally surrounded by Alexander's cavalry and pressed by the Macedonian infantry advancing in phalanx the whole Indian host was cut to pieces or fled "wherever a gap could be found in the cordon of Alexander's cavalry." On seeing that victory was being gained by their king, the troops left behind on the right bank of the river crossed and took up the pursuit, doing great execution among those who had escaped from the slaughter.

Finally Poros, who had valiantly fought through the battle, was forced to surrender. After recording Alexander's generous treatment of the vanquished king, Arrian tells us: "Alexander founded two cities, one on the battlefield, and the other at the point whence he had started to cross the river Hydaspes. The former he called Nikaia, in honour of his victory over the Indians, and the other Boukephala, in memory of his horse Boukephalos, which died there," as Arrian states, from age and exhaustion.

From the account of this hard-contested battle, the first recorded in history among the many by which invaders from the north-west successfully fought their way into the plains of India, we may now turn to the question which concerns us here. It is that of the ground which was the scene of this the greatest perhaps of Alexander's military achievements. I shall now proceed, in a succinct way such as befits this place and the time at present at my disposal, to indicate the new observations, partly topographical, partly archaeological, which I believe will help to settle the question. Before this however I must

briefly state the two contending opinions which have prominently figured in the discussions devoted to it.

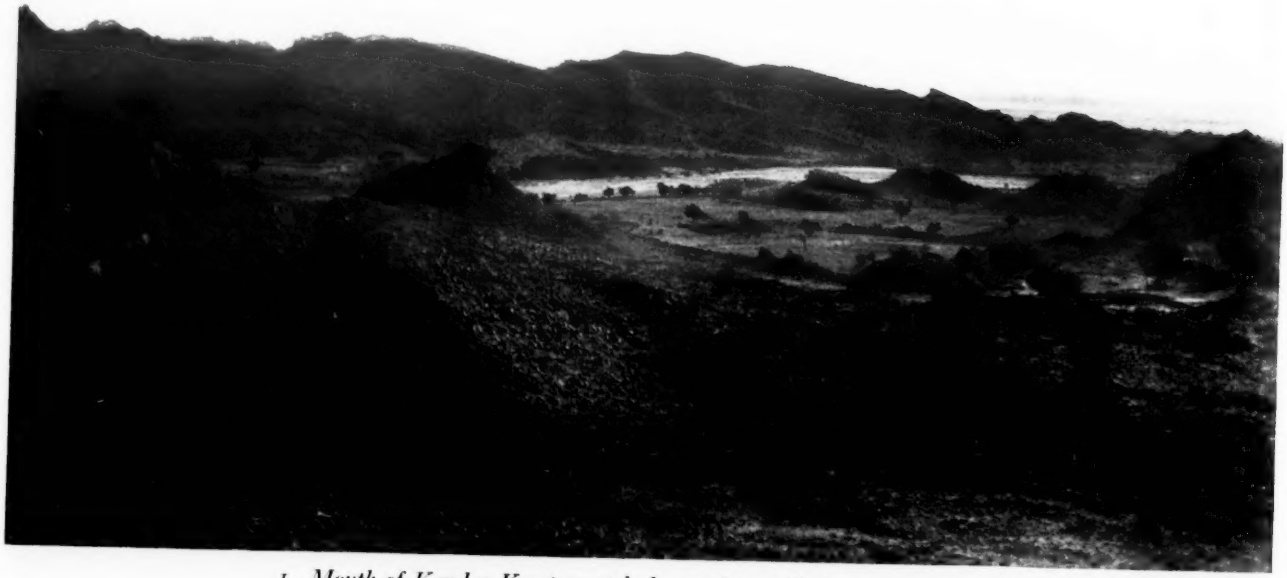
Both have had distinguished scholars among their champions. One, first propounded by Sir Alexander Burnes and M. Court, one of Ranjit Singh's French generals, would make Alexander reach the Jhelum at the town from which the Hydaspes, the ancient Vitasta of the Rigveda, derives its modern name. He is supposed to have marched there from Taxila across the Salt Range by the route which the present Grand Trunk Road follows. This view had been advocated at some length by General Abbott, the founder of Abbottabad, as long ago as 1852. It had been overshadowed for many years by the rival theory of General Cunningham, to be mentioned presently, but was revived with many a learned argument and widely propagated through the late Mr. Vincent Smith's very meritorious 'Early History of India,' and other publications based on it.

In a lengthy appendix specially dealing with the question Mr. Vincent Smith placed Alexander's crossing at Bhuna, some 10 miles above Jhelum town (see general map). There the river, after leaving the foothills, makes a bend though not a marked one. But, as any large-scale map would show, there is no "headland ascending from the bank of the river" to be found there, nor any deep ravine such as Curtius specially mentions. In accordance with this location Mr. Vincent Smith was prepared to look for the battlefield on the comparatively narrow stretch of riverine flat which to the east of the river intervenes between its left bank and the much broken ground at the foot of the Pabbi range of hills.

Before Mr. Vincent Smith took up the question at Oxford, with quasi-legal acumen but without close study of the ground, the theory put forth by General Alexander Cunningham in his 'Archaeological Survey Report for 1863' held the field. He placed Alexander's camp at Jalalpur, a small town on the right bank of the river about 30 miles below Jhelum. There one of the several routes leading across the Salt Range south-west of the Grand Trunk Road debouches, and there, as the general map shows, the river leaves the foot of a rugged projecting spur of the Salt Range which it washes for a distance of about 8 miles higher up before finally emerging into the open alluvial plain.

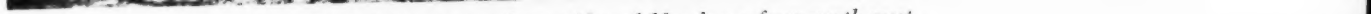
General Cunningham sought the place selected by Alexander for the crossing at the village of Dilawar at the upper end of the river's course along the foot of the spur just mentioned. But the distance between Dilawar and Jalalpur is only 8 miles and hence would not agree with the 150 stadia, or 17½ miles, which Arrian definitely mentions as the distance between Alexander's camp and the place of his crossing. In order to meet this difficulty about his assumed locations General Cunningham felt obliged to make Alexander's troops perform a night march by a very devious route. This he supposed to have taken them from Jalalpur up a narrow winding ravine that debouches there (see Plate 1), and then across its head by a difficult track into another winding ravine and thus finally down to Dilawar (see detail map). On this route the desired distance of some 17 miles would indeed be arrived at. But how a large force could be taken over this distance, across such difficult ground, in the course of a single stormy night, remained unexplained.

The Nestor of Indian archaeology had taken pains to study the ground and



1. Mouth of Kandar Kas torrent bed, seen from hill slope to north-west

2. ***Ruined Hindu temple on ridge of*** *Nandana, from north-west*



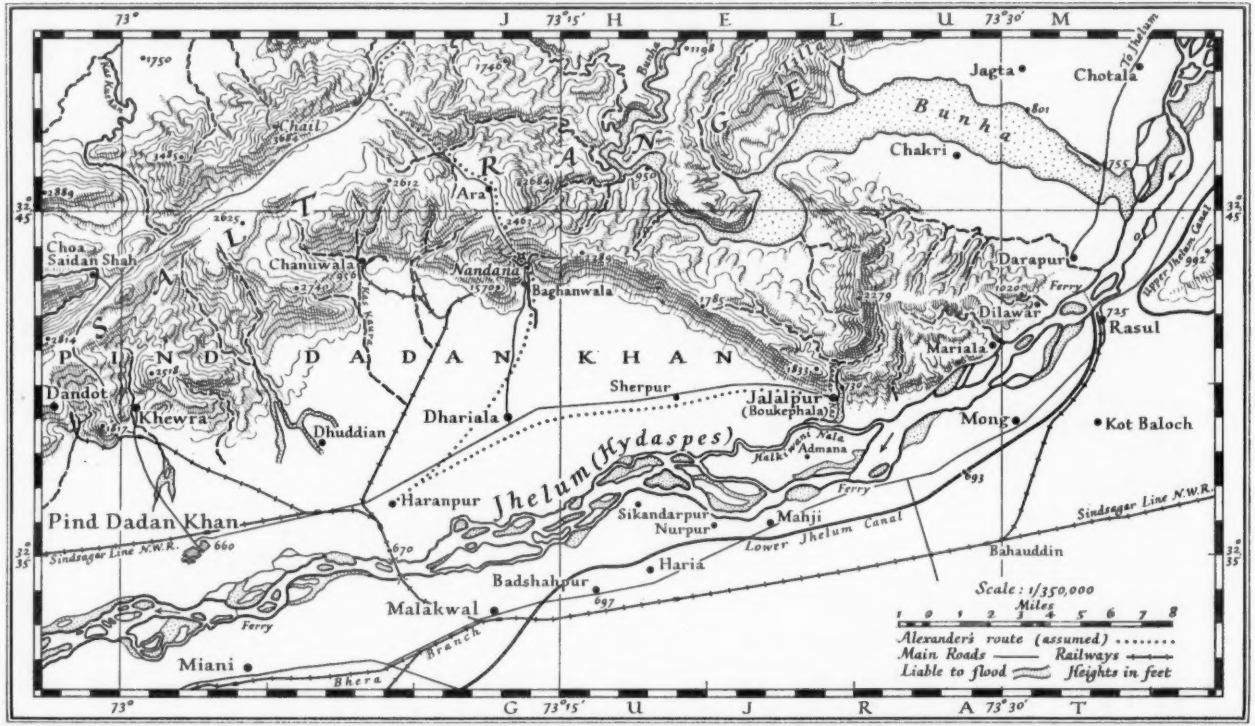
2. ***Ruined Hindu temple on ridge of*** *Nandana, from north-west*

had endeavoured to strengthen his theory by arguments drawn from such scanty topographical data as classical authors apart from Arrian and Curtius afford regarding Alexander's operations. Thus he rightly pointed out that the southerly direction indicated by Strabo for Alexander's march from Taxila as far as the Hydaspes distinctly points to a route having been followed that lay to the west of one leading to Jhelum town, like the present Grand Trunk Road. He also recognized that the distance of 120 Roman miles from Taxila to the Hydaspes, as recorded by Pliny from the measurement of Alexander's surveyors, is considerably greater than that measured to Jhelum, whether by the line of the Grand Trunk Road or by that of its predecessor which led there past the fortress of Rohtas. He rightly saw that this distance points to a route striking the Jhelum river lower down.

But the serious difficulty already hinted at about General Cunningham's locations remained, and some of the minor arguments adduced by him in support of them could not hold good against a critical examination such as Mr. Vincent Smith felt obliged to apply to them. It was certain that both the rival theories involved serious difficulties. What alone could offer a chance of clearing the question was a careful scrutiny on the spot of the recorded historical data in the light of topographical facts and of whatever definite antiquarian indications might be found there.

The search made by me with this object started towards the close of November in the vicinity of the town of Jhelum. Close examination of the ground to the east of the river conclusively proved that the battle with Poros could not possibly have been fought there as assumed by Abbott and Vincent Smith. Within 3 miles above the area opposite to the town, where according to their assumption the camp of the Indian army must have stood, there begins a series of marshy flood beds, which stretch right across the narrow riverine belt and with short interruptions extend for over 4 miles up the river. These beds of the Jabba, Bandar Kas, and Suketar Nullahs receive the drainage of numerous torrents descending from the Pabbi, Bhimbar, and Mirpur hills. They are from ½ to over 1½ miles in width where they pass across the riverine flat before joining the Jhelum. Quicksands remain in them even after the rains of the "hot weather" months have passed. During those months they are quite impassable whether on foot or horseback. A crossing can then be made only by keeping to the much broken ground at the foot of the hills to the east and by thus making great detours. The difficulties of this ground are well illustrated by the numerous and elaborately constructed bridgings and barrages over which the Upper Jhelum Canal taking off higher up the river had to be carried here.

It would have been an impossible proposition to take the large army of Poros with its chariots and elephants over such ground in the season of rains. It has proved equally certain in view of topographical facts clearly shown by the Survey of India's ¼-inch and larger scale maps that the limited width of the flat ground to be found beyond the marshy bed of the Suketar Nullah could nowhere suffice for a battle array such as Arrian records of the Indian army. This ground between the river bank and the broken foot of the hills is nowhere more than 3½ miles across and farther up steadily narrows. Taking Arrian's detailed figures the front line of infantry alone, protected by 200 elephants at a distance of a plethron, or 101 English feet, from each other, would have



Eastern End of the Salt Range: Route of Alexander

stretched over close on 4 miles. The chariots and the 2000 Indian cavalry drawn up at each of the wings must have extended the line greatly. And in addition to this there would have to be allowed sufficient room for the outflanking movement executed by Koinos's cavalry.

In view of such plain topographical facts there is no need to discuss at length other grave objections to the theory learnedly set forth by Mr. Vincent Smith. Such is the absence at Bhuna of anything in the shape of a "headland ascending from the bank of the river" or the fact that the distance from Jhelum to Bhuna is only about 10 miles instead of the 17½ miles mentioned by Arrian between Alexander's camp and the headland. But a brief reference may be made to the improbability of the leader of an army relying largely on the use of elephants and chariots having chosen the narrow stretch of tolerably flat ground between the river's left bank and the broken hills and ravines of the Pabbi range at his back as the place where to meet a formidable invader.

The route leading from Taxila to Jhelum is the shortest in the direction of such old centres in the plains as Lahore and Sialkot, and its use is attested from mediaeval times onwards. But before the Grand Trunk Road was constructed it was by no means the easiest route. Of this I had occasion to convince myself on an interesting excursion I made from Jhelum along the old line of the route. This passes the great fortress of Rohtas, which the Emperor Sher Shah constructed in A.D. 1542–3 to guard the narrow exit from the Salt Range into the riverine plain, and thence ascends towards the Bakrala pass.

To the south of Rohtas a steep portion of the eastern branch of the Salt Range culminating in the sacred hill of Tilla bars convenient access to the Jhelum for about 20 miles. There is no regular route leading across it, and for the same distance the near approach of the Pabbi hills to the left bank of the river and the broken nature of the ground at their foot preclude the idea that the place of Alexander's crossing and the field of battle with Poros could possibly be looked for there.

It is quite different with that portion of the Salt Range which beyond the Tilla hills continues for a considerable distance westwards. There it is crossed by a succession of routes which an invader coming from the north-west could conveniently use to reach the Jhelum and the open plain beyond the river. Apart from the route descending to Jalalpur, the only one to which Cunningham and his critic make any reference, there are at least four routes practicable for laden animals, including camels, to be found in regular local use between the wide bed in which the Bunha river, usually dry, makes its way to the Jhelum above Darapur (near Dilawar), and the route descending past the coal mines of Dandot.

The last-named route was undoubtedly used by the Emperor Babur when coming from the Peshawar side in November 1519. He then made his first successful inroad into the Punjab across the Salt Range, moving past the lake of Kallar-kahar upon the town of Old Bhera on the right bank of the Jhelum. It is not necessary to concern ourselves with each of the other routes I have just referred to, though I have taken occasion to visit them in parts. For fortunately there is one among them to which historical notices of an invasion far older than that of Babur's were bound to attract my special attention from the start.

Muhammadan chronicles repeatedly mention the fort of Nandana and the

pass in the Salt Range guarded by it in connection with the campaigns of Mahmud of Ghazna, that early invader of India, and also with later events down to the thirteenth century. The merit of having first correctly located this place, examined its surviving remains and recognized the importance of the route passing it belongs to my friend Mr. W. S. Talbot, C.S.I., late of the Indian Civil Service. While in charge of the Jhelum District and in the course of the Settlement conducted by him there, he took a special interest in its antiquities and historical past. He found the name Nandana still attaching at the present time to a remarkable hill stronghold (see Plates 2 and 3) which completely closes a route leading down steeply from a plateau of the outer Salt Range to the village of Baghanwala and the open riverine plain beyond it.

Before I discuss the historical interest attaching to Nandana and the bearing of its position upon the question of Alexander's route to the Hydaspes and of his subsequent passage of the river, I may conveniently quote the brief but very apt description of the position from Mr. Talbot's 'Gazetteer of the Jhelum District' (p. 46): "About fourteen miles due east of Choa Saidan Shah, between the villages of Baghanwala and Ara above, the outer Salt Range makes a remarkable dip; the road over the hills winds up the face of a steep rocky hill, with perpendicular precipices at the sides; so that in former days the holder of this hill had the absolute command of what is one of the most obvious routes across the range."

Nandana is repeatedly referred to in the accounts of the successive invasions of the great conqueror Mahmud of Ghazna. The events in connection with which it is mentioned leave no doubt about its position and about its having been an important stronghold of the last rulers of the Hindu Shahiya dynasty after it had been forced to retreat to the extreme north-west of the Punjab from its former possessions to the west of the Indus. Here it will suffice to refer only to those mentions of Nandana which at present can be checked in critically made versions from contemporary sources as presented in Dr. Muhammad Nazim's 'Mahmud of Ghazna' (1931). Thus we are told of Sultan Mahmud having in the spring of A.D. 1014 "marched to Nandana which, situated on the northern spur of the Salt Range, commanded the main route into the Ganges Doab" (p. 91).

A subsequent account records in some detail the defence offered at Nandana by the Hindu king's son in the "strong position between two hills at the junction of which the fort was situated." It tells us how after prolonged fighting beyond the upper entrance of the pass the defenders were driven back into the fort, which was then besieged and ultimately taken by the Sultan. The importance attaching to the route thus opened is attested by the special mention made of the Muhammadan commander to whom Mahmud entrusted Nandana when he returned to Ghazna after having pursued the fugitive Hindu king into the mountains south of Kashmir (p. 93). An earlier notice relating to A.D. 991 gives Nandana as the name of a whole district adjacent to Jhelum, and thus helps to bring out the importance of the place and the route past it.

I shall further on briefly mention the interesting archaeological observations which our survey of the Nandana fort and its ancient remains yielded. But here I may turn at once to the very useful indications which this oldest of historically attested routes across the outer Salt Range affords as regards the

location of Alexander's camp on the Hydaspes and the place of his crossing the river. A look at the map will show that the road descending the pass of Nandana to the pleasant village of Baghanwala will, if continued south past its abundant orchards and across the gently sloping alluvial plain below them, bring us to the bank of the river close to the large village of Haranpur. Now, at a distance of about 17 miles measured from there along the main road towards Jhelum, we come to the small town of Jalalpur, occupying a position that corresponds in a very striking fashion to Arrian's and Curtius's description of Alexander's crossing-place.

The town of some three thousand inhabitants is built on rising ground at the foot of a small outlier of the range which close behind it rises to a triangulated height of 1833 feet, or a little over 1000 feet above the river-bed. Immediately to the east of it there lies the wide winding mouth of the Kandar Kas (see Plate 5), a torrent bed with sandy bottom descending from the range and joining the river. Within less than a mile there passes a northern branch of the Jhelum, carrying much water at the time of the summer floods and known as the Halkiwani Nala. Jalalpur marks the south-western corner of that projecting spur of the Salt Range which, as already mentioned above, is washed at its foot by the river for a distance of about 8 miles between Dilawar and Jalalpur. Nowhere else along its course after debouching from the mountains does the Jhelum touch ground which could possibly be described as a headland or promontory (*ἄκρα*).

The spur all along falls off very steeply to the river and is broken by many narrow ravines. Only at the mouths of the latter is there room for scanty fields cultivated by three small hamlets. The road to Jhelum town, which used to run along the very foot of the spur and is still marked in Survey maps down to 1921, has been so badly broken in places by recent floods that it had to be re-aligned with no small trouble across the difficult ridges and ravines farther up. It can be safely asserted from the appearance of the cliffs above the river that the course of the latter must in historical times have always set against the foot of the spur.

The consequent difficulty of maintaining communication along it deserves to be specially noted, for it precludes the idea that demonstrations by large numbers of troops, such as Arrian and Curtius relate to have been made from Alexander's camp, could have taken place here. Yet Cunningham's location of this camp at Jalalpur would presume this. In the same way it would have been impossible to find room here for the force under Meleager, which we are told was posted by Alexander halfway between his camp and his selected crossing-place, if these had really been at Jalalpur and Dilawar, respectively, as assumed by Cunningham.

At Jalalpur, on the other hand, all physical features are in closest agreement with the facts recorded about Alexander's place of crossing.* There is the

*See above, pp. 33 *sq.* This close agreement of the physical features had been correctly noted already by Sir Mountstuart Elphinstone, who reached Jalalpur in July 1809 on returning from Peshawar across the Salt Range. Referring to its hills he says: "They came to the edge of the river, which, being also divided by islands, presents exactly the appearance one expects from the accounts of the ancients. So precisely does Quintus Curtius's description of Poros's battle correspond with the part of the Hydaspes where

headland overlooking the river at a marked bend; there are still plenty of such trees and bushes as the arid climatic conditions of the present day permit of, growing on the slopes east of Jalalpur; there is the ravine of the Kandar Kas between Jalalpur town and the point where the spur turns off sharply from the river; and what deserves to be specially noted, there is a large island stretching down from opposite Jalalpur between the Halkiwani and the present main bed farther south.

The winding bed of the Kandar Kas is overlooked here on either side by bold hillocks rising up to 300 feet (see Plate 5). At its nearest bends there adjoin stretches of fairly level ground now under cultivation. Thus the bed corresponds exactly to the *praealta fossa* or deep ravine which Curtius mentions as lying not far from the river bank and "capable of hiding not only foot soldiers but also men with horses." There are large groves of trees and tamarisk bushes growing on the ground which separates the town from the river-bed and which would thus admirably serve to screen preparations for an intended crossing.

The Halkiwani bed was partially dry where we crossed it on November 26 close to the mouth of the Kandar Kas, and about 55 yards wide. But from the middle of April until August it carries a large volume of water and is then quite unfordable. For the last three years great floods had come down from Kashmir and the current had set increasingly towards Jalalpur. On the opposite bank we found the ground of the island uncultivated for over 500 yards and large trunks of timber left on it by the flood. The island is occupied by the hamlet of Admana and some scattered homesteads belonging to it. Its length is now approximately $4\frac{3}{4}$ miles and was slightly greater when the last survey was made, the 1-mile-to-the-inch map of 1911 showing it as $5\frac{1}{4}$ miles. Its maximum width is now about $1\frac{1}{2}$ miles. High tamarisk bushes cover a good deal of the ground left uncultivated, while a thick wood has grown up in a "Reserved Forest" area. About half of the island is included within the boundary of the Gujrat District to the south, which suggests that at a time not very distant the main bed of the river lay farther north.

But however this may be it is certain that the island as it exists now is by far the largest of any which survey maps show on the Jhelum within the whole length of its course that can come into consideration here. This point has also its interest. Though islands in a river like the Jhelum are liable to changes, yet the course of the river and the general character of its bed are not likely to have changed here greatly during the last two thousand years; for they are largely determined by such permanent geographical features as the Jalalpur hill spur and the high ground at the end of the Pabbi range facing it. And Curtius (VIII, 13) tells us of an "island larger than the rest, wooded and suitable for concealing an ambuscade."

If then we assume that in Alexander's time there lay close below Jalalpur an island much of the same type as the present island of Admana, it is easy to

we crossed that several gentlemen of the mission, who read the passage on the spot, were persuaded that it referred to the very place before their eyes." (Cf. Elphinstone, 'An Account of the Kingdom of Caubul and its Dependencies, in Persia, Tartary, and India,' revised edition, 1842, i, p. 108). Not in vain has it been said of that great administrator and student of geography that "he could look through the mountains."

follow the successive phases of the crossing as recorded by Arrian. Moving down the channel approximately corresponding to the present Halkiwani, the boats and rafts would carry Alexander's troops to the junction of that bed with another more southerly river branch. Then on being rowed across the united channel his rafts would let them land on what might well appear to them as the mainland on the river's left bank. In reality it proved another island "separated from the mainland by a branch of the river in which the water was shallow." Arrian's account brings vividly before us the most critical phase of the whole boldly conceived enterprise and how it was met by Alexander's unflinching determination and the wonderful pluck of his hard-tried Macedonians.

Our own experience helped curiously enough to illustrate this episode. We crossed the sandy main bed of the river from the point where the Halkiwani joins it and found it nearly a mile wide. But apart from large pools it held water only in one shallow channel about 250 yards across at the time. Then we passed for close on a mile over ground which had all the appearance of mainland, being in part treated as a "Reserved Forest" area, before we came unexpectedly upon a small channel with flowing water, only 50 yards across. Shallow at the time, it was said to be quite unfordable during the time of the summer floods. It had obviously formed since the last survey was made in this area some twenty years ago. Beyond it the fertile tract, now irrigated by the Lower Jhelum Canal, was entered near the village of Nurpur.

It is on this absolutely open and flat ground stretching south of the left bank of the river that we must assume the battle with Poros to have been fought. But it is quite impossible to determine the exact position of the battlefield. We have no definite indication as to the distance from the place of landing at which the main force of Poros was encountered, though Plutarch in his 'Life of Alexander' (Chap. lx) mentions that Alexander had ridden some 20 stadia ahead by the time he fell in with the small Indian force of horsemen and chariots first sent against him. Two points however must be noted. One is the perfect openness of this ground which allowed ample room for the extensive line in which Poros marshalled his army. The other is that room was left between its left wing and the river for Koinos's outflanking movement.

Now with regard to the latter point it is of interest to observe that the present river-bed beyond Nurpur makes a considerable bend to the north-west, the triangular stretch of ground having its apex near the small village of Sikandarpur. If this bend existed already in antiquity it would make it easy to understand why Poros did not rest his left flank on the river. For if his army started from a place somewhere opposite Haranpur where Alexander's camp may approximately be located, *i.e.* from some point near the present towns of Malakwal and Miani, the direct line for an advance to meet the landed Macedonians would, as the map shows, have kept the Indian army away from the river anywhere near that bend.

Since we cannot exactly locate the battlefield it is also impossible to indicate the site of Nikaia, the town which Alexander is said to have founded there to commemorate his victory. Along the river's left bank, below the point where it may be assumed to have been reached by Alexander crossing from Jalalpur, there are to be found now the large villages of Majhi, Haria, and Badshahpur. They are all built on mounds rising well above the alluvial plain and marking

prolonged occupation. But I found no definite indication which would justify even a tentative identification of any of them with the site of Nikaia.

As regards Boukephala, the town founded by Alexander on the right bank, we are in a better position. Since Strabo distinctly places it at the point where Alexander embarked for his passage, and Arrian's reference (see above, p. 35) is compatible with the same interpretation, we may safely locate it at Jalalpur.* In support of this it deserves to be noted that coins found at Jalalpur include issues of the Greek kings who ruled in parts of Afghanistan and the north-west of the Punjab. As already recorded by General Cunningham, the numismatic evidence afforded by these coins and the still more frequent ones dating from Indo-Scythian rule clearly proves occupation of the site during the centuries immediately before and after the Christian era.

There still remains to give a brief description of the route leading down from the Salt Range through the pass of Nandana and of the remains of the ancient stronghold, a true *chiusa*, which guarded it. This route starting from Ara may in view of the explanations given above well claim our interest as the main one that saw Alexander's columns descend to the bank of the Hydaspes. There the outer or southern one of the two more or less parallel chains of hills into which the highest portion of the Salt Range here as elsewhere is divided, dips down steeply towards the riverine plain.

Between the two chains there extends a series of small open valleys fertile at their flat bottoms and situated at elevations between approximately 2000 and 3000 feet. Approach to them is easily gained by roads which traverse the broken, but all the same for the most part cultivated, plateaus stretching to the west of the Grand Trunk Road and the railway line between Taxila and the town of Jhelum. Five or six marches of ordinary length would suffice to cover the distance, approximately 80 miles in a straight line, but of course longer by road, between Taxila and Ara. Which of the several practicable routes between the two places Alexander's forces are likely to have followed, past Chakwal or Rawalpindi, Chauntra and Dhudial, and other places of larger size, we shall never know, since no definite indications are recorded.

Near the village of Ara an almost level plain, over 2 miles across and well provided with water, would have offered a very convenient camping-place for a force before starting on the descent to the river. It is here that we must assume, more than thirteen centuries after Alexander's passage, to have taken place that battle between Mahmud of Ghazna and the Hindu ruler which the Muhammadan chroniclers mention as having preceded the former's siege of the fortress of Nandana in A.D. 1014. From the elevated rim of the Ara plateau, at a height of about 2400 feet, a steep winding road leads down over the rocky scarp of the range for close on 2 miles to where a narrow depression at an average level of 1300 feet extends between two small valleys uniting farther south below the ruined stronghold of Nandana (see Plate 2).

*Already General Cunningham had rightly identified Boukephala with Jalalpur. But he apparently did not realize that by doing so and yet looking for the place of passage at Dilawar he came into direct conflict with Strabo's definite statement. We have here one of the instances where a kind of true antiquarian instinct led that distinguished first explorer of India's ancient sites to arrive at identifications which have proved right in spite of the inconclusive or otherwise defective arguments he advanced for them.

3. Ruined bastion at eastern end of fortified ridge, Nandana

4. Eroded hills above Kandar Kas bed

5. Jalalpur, from across the mouth of the Kandar Kas

5. Jalalpur, from across the mouth of the Kandar Kas

The road so far, though very stony, is perfectly practicable for laden animals, including camels, even in the neglected state in which it has fallen since most of the local traffic from this part of the Salt Range to the river has been diverted to the Grand Trunk Road in the east and to the road practicable for carts between Chakwal and Pind Dadan Khan in the west. The road in a number of places shows distinct marks of having been cut into rocky ledges to secure a better gradient. Though perhaps not so well aligned, it reminded me of the ancient roads constructed in Buddhist times across the passes connecting Lower Swat with the Peshawar Valley.

Immediately above the depression just mentioned, forming a kind of natural fosse, there rises very abruptly a rocky ridge bearing on its top the ruined structures of Nandana and along its precipitous northern slopes the remains of a boldly built line of wall (see Plate 3). This fortified ridge completely bars further descent on the route; for the two small valleys already mentioned turn on either side of it into deep and extremely narrow gorges flanked for some distance by almost vertical rock walls, hundreds of feet high (see Plate 2). These gorges are completely commanded from the ridge and would allow of no passage even to men on foot as long as the ridge were defended. Nor could the heights towering above them be readily climbed and the ridge reached from them by arrows or similar missiles.

The wall running along the north face of the ridge for about 300 yards was very massively built with large uncut slabs of stone quarried on the spot. But owing to the steepness of the slope its foundations have given way over most of its length. But some circular bastions solidly built with slanting walls and large slabs of cut stone have stood their place in great strength and bear a look of considerable antiquity. The slopes below the top of the ridge and within the defences are covered with the debris of rough stone walls wherever there was room left for dwellings, and between them there passes the road across a shoulder of the ridge.

The highest portion of the ridge rises some 200 feet above the depression previously referred to. Its top bears the ruins of a Hindu temple (see Plate 2) and at its other end the remains of a large structure too badly injured for safe determination of its character (see Plate 3). The temple probably dates from the times of the Hindu Shahiyas, but the very high and massively built terraces on which these ruins rise are certainly of far greater antiquity.

The southern face of the ridge is for the most part lined by cliffs so steep as scarcely to need defences. But where the road winds down it in steep zigzags it is guarded by a very imposing round bastion built with large and carefully set slabs. About 500 feet below the top of the ridge the road thus defended reaches the valley bottom where the two spring-fed streams descending the gorges unite. The rivulet formed by them runs for half a mile in a picturesque narrow valley before it is caught at its mouth in small canals to carry its life-giving waters to the orchards and fields of the large village of Baghanwala. Appropriately called after its gardens, Baghanwala looks a veritable oasis at the otherwise arid foot of the frowning hill chain. It might have well provided a very suitable place of residence in times of peace for whoever held charge of Nandana, that ancient gate of the Salt Range.

Ten miles across the alluvial plain below Baghanwala bring us to that point

near the village of Haranpur where the Jhelum, flowing in a single well-defined bed, offers a particularly convenient crossing-place. This is proved also by the position of the bridge over which the Sindsagar branch of the North-Western Railway here passes the river. It is here that we may look for the place where Poros guarded the river passage and where Alexander's main camp stood facing that of his adversary.

I have already had occasion to point out that the road distance between Haranpur and Jalalpur corresponds exactly to the 17½ miles recorded by Arrian between Alexander's camp and the place where his passage of the Hydaspes took place. It only remains to add that, as the map shows, the present road between the two places runs at such a distance from the river as would have effectively screened the final move of Alexander's force from the enemy's observation, a point specially mentioned by Arrian.

As I stood by the rocky brink of the range near the rest-house of Ara and let my eyes sweep down the defile of Nandana to the glittering line of the waters of the Hydaspes and across the vast fertile plain beyond it, I felt as if caught by the thoughts with which some of Alexander's brave war-hardened Macedonians might well have viewed this great vista. The mountains and deserts across which they had so valiantly fought their way under their young king over vast stretches of Asia, lay now behind them. But would not these interminable plains stretching away to the Ganges, inviting as all the riches and strange things there might appear to their incomparable leader, ultimately set a limit to the world conqueror's ambition and force him to give way before their longing to return to their distant homeland?

THE ASSASSINS' CASTLE OF LAMBESAR

FREYA STARK

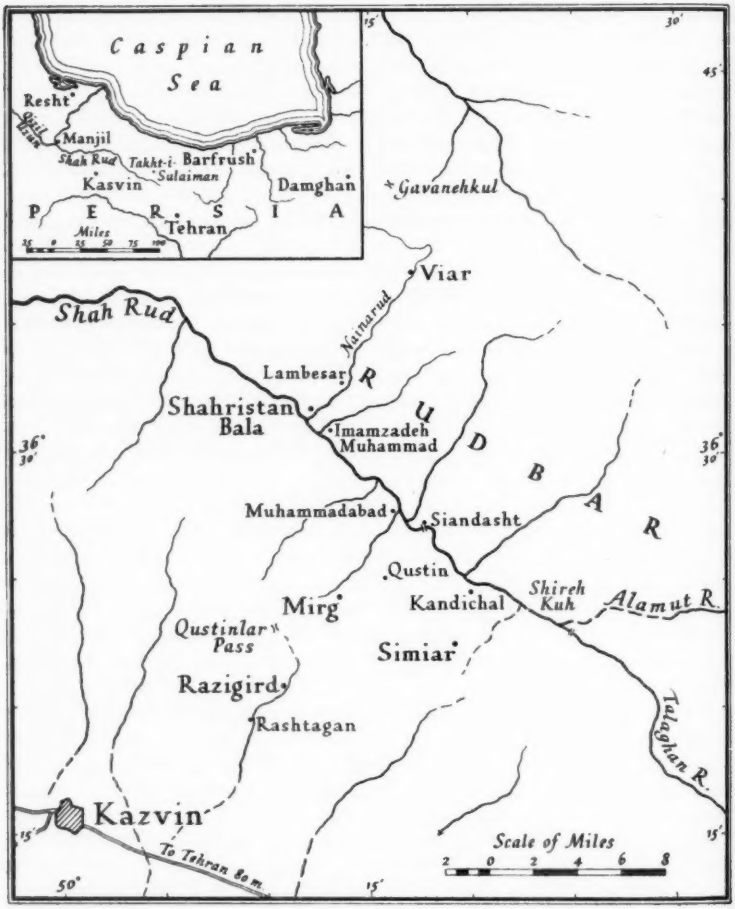
WHEN Hulagu the Tartar devastated the Middle East in A.D. 1256 he took and destroyed among others fifty or more castles of the Assassins. Of all these strongholds, which one hears of over the north of Persia from the borders of Khurasan to those of Arabian 'Iraq, only two are mentioned as having put up any long resistance. These are Girdkuh and Lambesar, of which the sites have hitherto been unknown. They held out for six months, long after the last Lord of Alamut had been taken away a captive and murdered in the hills by his enemies, and long after the Rock of Alamut itself had, much against its will, been forced by its own master to surrender. Lambesar and Girdkuh held out, and the story goes that, as far as Girdkuh is concerned, it could have resisted even longer, but was forced to capitulate owing to a shortage not of food or water, but of clothes.

The Mongols were not a mere horde without engines of war. They carried out their sieges in a scientific manner, with Chinese engineers, and every appliance, and with special auxiliary troops familiar with countries unknown to themselves. The places that could stand so long against them must have been particularly formidable. There are not many clues to their whereabouts, except that Girdkuh is mentioned by both Yaqut and Mustaufi as being visible and about a day's journey from Damghan. Lambesar is only known before its final siege and fall as having been captured for the Assassins in the year A.H. 495 (A.D. 1083) by Kiaya Buzurg Ummid, the vizier and successor of the first Old Man of the Mountains. He was a native of Rudbar, which is a mountain region north of and including the Shah Rud valley from its junction with the Qizil Uzun at Manjil to the beginning of the Alamut and Talaghan valleys on the east. When I was in Kazvin last year, and a Persian friend, knowing my interest in castles, told me of an old ruin called Lamiasar, in the district of Rudbar, I was therefore very much interested, and though I had nothing but the name to go by in a country of about 10,000 inhabitants, and though it is very malarious there in summer, I decided to cross the ridge from Kazvin and to explore.

I went north to Rashtagan and had lunch there in the heat of the morning under plane trees and willows by a shrivelled summer stream. It was the beginning of August. The only flowers left were mint and willowherb, michaelmas daisies, and a small pink stock growing round the water. The corn was out on numerous threshing-floors terraced up at one end of the village: its yellow heaps stood against the mountain background, fine in a barren way, where the northern passes climb across the ridge. In the foreground in the sun old men and boys drove black oxen slowly round in a circle, dragging clumsy rollers with wooden spikes to tread out the corn; while in another place the young men were busy with the winnowing, and the chopped straw, as they tossed it up on forks, hung like dust in the air.

The party consisted of Ismail, myself, and two mules. My own man, 'Aziz, whom I knew and liked from the year before, was kept in his village in the Alamut valley by the illness of his small son, and when at last my message penetrated to him, after I had been chafing in Kazvin for nearly a week, he

hastened to send for his mules, who were enjoying their yearly month's holiday of pasture somewhere a day's journey away in the hills, and dispatched them to me together with his servant Ismail. Ismail looked like a convict: he had one of those heads which seem flattened at the back, and his limbs, as they slouched along, seemed to keep together by pure accident. His clothes had the



Sketch-map of the Shah Rud Valley, Northern Persia

same sort of casual dilapidation; the sleeves of his tunic began halfway down his arm and ended long before his wrist; his loose blue cotton trousers were suspended by some inadequate method which demanded constant hitching up; and he was hung round with about six different straps and bags in which his amulet, his money, his knife, packman's needle, and other objects were all

separately housed. He wore a battered cap with a peak. My field glasses, slung across him jauntily, gave a last incongruous tourist touch. He was terribly stupid. His daily food, which consisted of an ancient cheese in a furry bit of goatskin round his neck, made him very trying at close quarters. "Into the hands of God may you be entrusted," said the waiter of the Grand Hotel, as we left Kazvin; and as I started out for the hills with Ismail as my sole companion, I felt that some such pious wish was required.

At Rashtagan we had difficulties because the patch of grass under the trees where I sat was the only village patch, and too precious for mules to eat it up. Ismail was made to tether them some way off, while a shrill woman, who had argued the point, suddenly collapsed into friendliness and, squatting down with her samovar, prepared to feed me with tea and eggs. She had a quick, lively face, with dancing eyes and a gaiety apparently accounted for by the non-existence of her husband. "This," I find noted in my diary, "often appears to be the cause of cheerfulness among the Persian ladies." With her was a girl of thirteen or so, a bride of one year, who told me that she spent the summer up here in a little hut of boughs to enjoy the open air away from the village. It is a charming trait in Persia that any one you meet understands the pleasures of a picnic and will make the best of all the trees and brooks and grassy places that they have.

We rested here till the worst of the heat was over, and then climbed upward among fields where the corn was cut, stacked in round heaps with the heads towards the centre, and covered with leaves and stones against the birds. The peasants were about, gathering it in to the threshing-floors, and ready to pause and greet us as we passed. The little stream, hidden in its sunken bed by a tunnel of trees, kept on our right side, until we reached the level of Razigird, and forded it, and began to climb in a bare dull landscape streaked with strata of light-green rock and outcrops of white limestone here and there. The stream, which they had called Pile Rudkhaneh, the Big River, in the plain below, now appeared on our other side, coming out of a steep uninhabited valley with clumps of willow trees and planes but no cultivation. Here it changes its name and becomes Pas Duzd, the Track of Thieves.

A little parallel range of foothills with grassy lands behind them runs between the main range and the Kazvin plain. We looked down on these, and on the gardens of Kazvin and its minarets beyond, nearly invisible in the distance. The track to the Simiar pass was on our right, hidden from us by the round and shapeless contours of our range. Round us were many flowers as we rose higher, dianthus and thistles of various kinds, thyme, borage, a tiny forget-me-not on a long stalk, and many others I did not know. And we met company all the way—men from the Shah Rud valley bringing loads of melons to the Kazvin market—for this is one of the lesser passes for local traffic only, and the strong mules of the more eastern tracks are here replaced by donkeys, who do the journey to Kazvin in a day. Laleh Chak, the name of the pass, is not marked on the map, though its height is given.

We were three hours climbing up from Rashtagan, and were disappointed at the top, for there was no forward view, but only the one behind us to which we had become accustomed over the plain. But after walking twenty minutes along the grassy level of the ridge, with its points rising in low outcrops of rock

from the rounded knolls, the Shah Rud valley suddenly opens, below. Its saw-edge of pinnacles runs in a long eastward line to Alamut and the high massif of Takht-i-Sulaiman beyond, like lines of a fortress rising to the keep. There was no snow, for we were looking up the southern face, but a bitter wind blew down this great funnel of the hills. Opposite, rising to a gentle blue peak on the other side, lay the straight valley of Javanak, open like a map. The slopes below us were squared in cornfields; their green village patches and ravines o unseen rivers were already melting into the dimness of evening. The most noticeable thing in the landscape was its silence: immense and grey, without a voice of any kind, it lay under the falling night.

I told Ismail to make for a small wooden shanty far below which we had been told of as an inn, and to order pilau while I stayed to take some bearings. This took longer than I expected, and when at last I started down in the dusk I felt singularly lonely at the top of so wide a solitude. Soon I came to the first cornfields, high up and still unharvested. Ismail and his mules had long been invisible, and my feeling of solitude was made rather more acute than before by the sight of three men with reaping-hooks leaping down the hillside to intercept me. A reaping-hook looks unpleasant in the hands of some one whose intentions one is not sure of, and the three were waiting for me in silence as I came along the path. But a Druse guide long ago taught me two things: that one should be careful to keep behind people one is doubtful of, and that one should call out one's greetings from as great a distance as possible. "Peace be upon you," said I. "Is the hotel a long way off?"—or words to that effect. "Upon you be peace," they replied in chorus, and came forward in the most friendly way. The hotel, they said, only gave tea by day to the donkey men, and by night its owner went to sleep in a village much lower down. But they would take me to their own village, they said. "Where is that?" I asked. "Just here," said they, and pointed almost perpendicularly downwards to where, on a spur of our mountain, a little patch of houses and trees in a fringe of threshing-floors pushed out between two ravines. This was Mirg. "Very well," said I; "but you must call Ismail."

Ismail was now visible, a small figure far away on the curve of the next hill. The tallest of the three men put his hands to his mouth and shouted down into the dusky spaces: "Ya Ismail, ya Ismail, heh!" A faint voice answered. "Take the path to the left, the left, heh." We waited, and a faint voice came back. "Above the stream, the stream, heh." Again a reply. "To the village, village, village, heh." Ismail turned his mules round.

My new friends were Kurds. The Shah of that time had settled them here about a century ago, and they had lived in Mirg ever since, still keeping their own language, though they all seemed to speak Persian as well. Englishmen who had mapped this country years ago had stayed in their village. "And what are *you* looking for?" they then asked, having answered my questions. "I am looking for a ruin called Lamiasar," said I. "Lamiasar?" said an old man, who had just come ambling on a donkey behind us with a load of grass under one arm. "Lamiasar is there," and with the sickle in his other hand he pointed far away across the Shah Rud to a fold in the hills. "You can get to it from here in one day." So kind is fortune if you trust her.

Rustum Khan, the owner of Mirg, was a long-faced Kurd with pleasant

manners. He sat in a whitewashed room furnished with carpets and quilts and three or four chests covered with painted tin and gilt and nails studded in patterns. In the niches in the walls were lamps with glass globes, two pink and two green. Little brass trays to hand glasses of tea hung on the walls between niches, two by two. The brass samovar was in a central position. All these furnishings belonged to the young wife, blonde and fresh and plump as a German, who spoke a quite incomprehensible dialect from Muhammadabad in the valley below.

It was a friendly village. There were only twenty houses. The school, for such as wished to go, was several hours away down by the river. The village itself however owned a bath. In winter, they told me, it is so cold that even wolves do not venture out much. Rustum Khan sits under his *kursi* burning charcoal from the Caspian Jungle, which takes four days to reach him. He was an educated man, who had spent a year in Tehran, and had been a friend of the Emir Sipahsalar at Tunakabun, the great man of these parts whose financial difficulties with the Persian Government caused him to commit suicide at the age of eighty. Rustum spoke of him with affection. He also spoke pleasantly of the British who had been his guests, and told me how one of them had brought a Persian lady; but while staying at Mirg, he received a cheque from his father together with a demand for his prompt return without her, and seems to have left her in Kazvin—a proceeding which the Kurds thought amusing but very comprehensible. They were under the impression that Arabic is the British language, and surprised when I told them that we have a language of our own.

About eleven I was able to go to bed—on the roof. All the village laid itself to rest on the roofs around, so that we lay, as it were, in one flat dormitory under the stars. Over the hills of Rudbar, Cassiopeia and the Milky Way hung below me as it seemed. I was troubled through the night by incessant snuffling and grunting close by, and thought indignantly, as I lay half awake, that there must be pigs, and that my hosts must have thought that, as a Christian, I would not mind sleeping beside them. Then I sat up to trace one very loud grunt which seemed to come from just under my head, and discovered its origin in the sleeping form of either my host or hostess, who had arranged their mattress close to my bed on the roof. The pigs next morning turned out to be nothing but a flock of sheep penned in among the houses.

Next morning a Scotch mist hid everything. It hung in drops on the cobwebs and the brambles, and the cornstacks in the fields. It often covers the Shah Rud valley for days like a ceiling, coming up from the Caspian; one can see it from below, breaking like waves over the northern ridge. It made the earth smell deliciously as we left Mirg. With Rustum Khan as our guide, we followed a track tilted on the hillside like a sailing vessel under canvas, so that it was hard not to slip off it now and then. Rustum Khan was taking us to see the castle of Qustinlar, which is on his land. It holds a commanding position, and must have been built to guard or prevent communication with the Kazvin plain over the passes; but there is nothing left except the rudiments of an outer wall badly built of rough stones embedded in mortar, and enclosing a space about 800 feet by 50 feet. Having seen this, we left Rustum Khan, and came down by the cornstacks and threshing-floors of Qustin, and thence after four hours reached the ricefields in the lowlands of the Shahrud at Siahdasht.

The bridge of Siahdasht and that of Shireh Kuh higher up were said to be the only ones not yet washed away, and the river was too full to ford so low down. The bridge was therefore important. Rustum Khan however had been giving us statistics of mules and muleteers drowned with the bridges they happened to be crossing. The new one is never built till the old one is swept away, which usually happens under the weight of the last muleteer, so that the crossing of bridges towards the end is rather like musical chairs when the music may stop at any moment. When Ismail saw what he had to get over, he was nervous, for the loose poles were shaking even under my weight alone; the mules were led after, separately and very reluctant; and Ismail wiped his forehead and thanked several Imams when the strain was over.

We were now in the region of mosquitoes. They buzzed about even by day, and it was impossible to escape. One could only take quinine and hope for the best. We found a garden, a little above the ricefields and stagnant pools, and rested there in the company of a wandering tortoise, some village women, and an inquisitive suspicious man. The garden was dark with fruit trees and deep grass; from its lovely shade one looked down the glittering sunlit windings of the river whose enfolding mountains, high but far apart, sank into lower and bluer distances in the west.

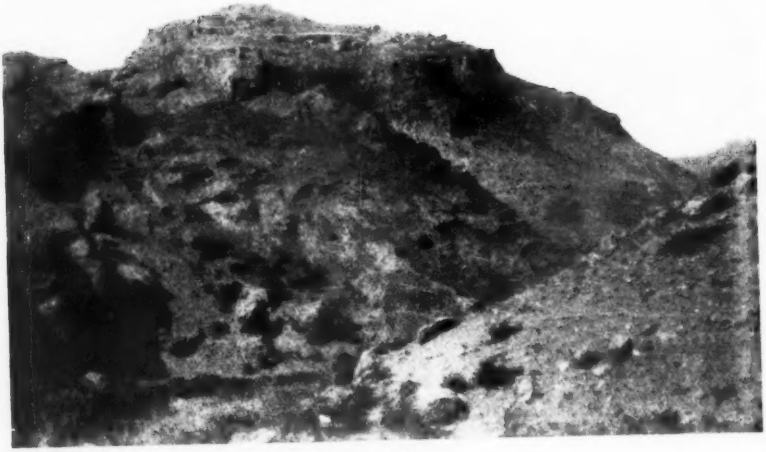
It is a beautiful valley, rich and open and remote: the ancient kingdom of the Dailamites, who held Rudbar as a fortress and hence descended on the townsmen of Kazvin. It now grows cotton and rice, castor oil, tobacco, and much fruit and vegetables. There is no road worth speaking of. As we rode on again in the afternoon I had to dismount for long stretches where the track, clinging to red cliffs steep to the river, and nearly washed away, was almost too narrow for the mules' feet. Then we would climb down to the water-level, cross the estuary of some tributary from the north, and go for a long stretch through ricefields or flat stony waste ground flooded in spring. Far ahead of us we saw Shahristan Bala, the capital of the district, though only a large village in groves of walnut trees. It seemed to get no nearer as the hours passed, and I began to have difficulties with Ismail, who was tired and furious at being made to come into this hot unhealthy country. Near seven o'clock, in the sunset, we reached the Imamzadeh to Muhammad, one of the sons of Musa of Qadhim. It stood on a river cliff with cornfields and half a dozen houses round it; and we decided to stay for the night, and take such hospitality as we could find.

The little Imamzadeh was whitewashed, and held a wide view from its flat headland. It had seats all round it made out of carved tombstones a century or two old, laid on mud ledges. As I sat there taking bearings a black scorpion came crawling from under one of them and walked off with malevolent dignity.

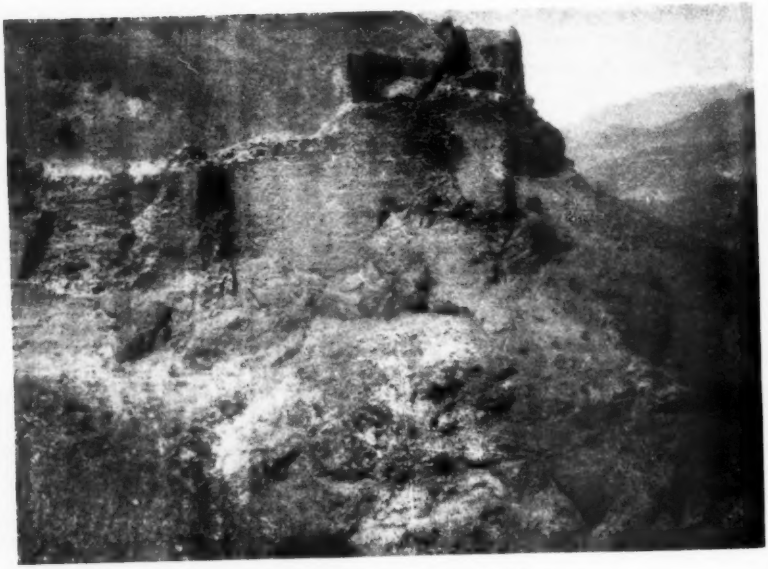
Through my glasses I could examine the ruins of Lambesar, now clearly visible on a truncated hill to the north (11° by my compass) and about one and a half hours' ride away. The people knew the way up, for the big sloping space within the walls is used to feed flocks of sheep. It and the villages around belong, the peasants told me, to a Sardar who lives in Kazvin but comes in summer to look after his cattle. Next morning we passed by his house above Shahristan, a smart country place on the way up to the castle, with wooden colonnaded portico round its yard and a decent road and avenue of poplars leading up to it.

Crossing the Shah Rud

The Shah Rud valley



Lambesar



Walls of Lambesar castle

Meanwhile we sat among the peasants in a circle round their fire, hoping to keep mosquitoes away, and distributing quinine. A traveller is made welcome over all this country if he has any of this drug with him, for though it is only one day's journey from the Kazvin plain, and nearly every one is stricken with malaria in one form or another, the men of the valley are too poor and too ignorant to buy it for themselves, and there is no doctor.

A fine old man, an old Aryan with the long face and short beard of the Persepolis friezes, volunteered to take us next morning. We left our baggage in the care of the peasants, and, taking only lunch and a samovar for tea, started off across red stubbly hills and little dry valleys.

The castle of Lambesar, or Lamiasar, is about 2 miles north of Shahristan, on the banks of the same stream, which is called the Nainarud. The easy way is to keep up on the side of the western hill and to reach it by a neck which joins it on the north to its mountain background. We however were misled, and after getting involved in ricefields of the Shahristan villages, which spread a long way northwards from the estuary of the Nainarud, we struggled up towards the castle from a precipitous ravine, until the smooth steep ledges became too much even for our unburdened mules, and leaving them, with the battlements looming grimly above us, we scrambled up a slope of blackish rock where pomegranate bushes grew, to the western gate of the fortress. The walls are no longer intact on the summit of their mountain of rock; but their ruins, and the fierce and gloomy valley, are impressive as ever. Some such places Dürer etched, with no softness of vegetation anywhere around them, but high buttresses and precipices alone. The battlements of Lamiasar have crumbled, but they still dominate the landscape at a little distance as they follow in and out the contours of the truncated cone of hill and enclose a sloping surface about 1500 feet long by 600 feet wide, where the remains of buildings are scattered.

There is not much masonry on the long western side; the natural precipice must always have been a sufficient defence in itself, and a series of small towers stood here on every out-jutting point, a bowshot one from the other. On the south and east the ramparts still exist, built of rough stones taken from the hillside apparently at different dates, for some parts are made of much smaller stones than others. They go in and out, following the natural line of the hill with the effect of a Vauban fortification long before its time, and the attacking forces must have had their flank exposed almost at every point. On the north alone the approach is possible, for here is the neck which joins the castle to the mountain side behind it, and here the water conduit once came down from the upper village of Viar, visible through a narrow defile of the Nainarud. This must have been the most delicate part of the defence, though I could see no trace of any ditch or outer fortification to protect the northern gate; but the gate itself and all this part is very much obliterated, and some strong defence there must have been, since, once this height were captured, the whole of the castle enclosure sloping away from it downhill would lie at the attacker's mercy.

The southern gate, which is 500 feet lower than the other, is much better preserved. Its outer entrance faces west, then turns, with the ruins of a guardhouse on its left, north-west into the enclosure. There is a difference of about 20 feet in the level of the inner and outer gates, and their actual doorways

are built of big squared stones. In the enclosure itself are the ruins of a good many buildings, some quite modern and probably left by shepherds in later times. It does not look as if the castle had ever been used again after its capture by Hulagu. There are shards of pottery by the thousand lying about on the ground, all of an early kind such as are found at Alamut also; but of the eighteenth-century ware which witnesses to the later existence of the Rock of Alamut, Lambesar showed not a trace.

The chief building seems to have been right at the top, below the north gate. It covered a space about 100 feet by 85 feet, and there are twelve long narrow rooms facing to the east, with a tower in the south-eastern corner. The southern part of this building is the best preserved, and still has its doors with pointed arches leading from either end into a passage, and doors opening on each side into rooms 6 yards long by 2 yards wide, vaulted, with very rough windows, and with places for bolts visible in the stone. The thickness of these walls is 3 feet 10 inches. It is all very clumsy work, and part of it composed of enormous stones or, rather, boulders.

Along the outer ramparts no buildings are left standing except part of two small towers on the western side, built of much smaller stones than the keep above, and with two rounded niches and small pointed windows still left intact. The windows have no keystone, but a tongue of mortar instead, and looked to me more recent than the great blocks higher up. The general level of the ground does not seem to have altered much, for the drainage holes visible on the outer face of the rampart are still in their proper places according to the present level.

Besides the more modern buildings, there are vaulted rooms here and there half buried in the middle of the enclosure, and doubtless a very little digging would restore the original plan of the fortress. The most interesting part of it at present is its arrangements for water, which can still be clearly traced. The leat from Viar came down to the castle along the northern neck and was received into rectangular cisterns, about 6 by 2 by 2 yards deep, dug into the solid rock. I counted three of these just outside the castle walls on the north and east. In times of siege numerous other cisterns of the same kind, some finished inside with mortar and vaulted over with masonry, some merely cut into the stone, stored the water within the walls. They are scattered everywhere, and probably each dwelling had a tank of its own, like the Assassin castle of Sahyun, in Syria. In the lower part of the enclosure a stone belt which runs across from west to east contains a row of these cisterns close together, the largest one being over 40 feet long. Here the rock still shows traces of a small conduit cut to run water from one cistern to the other, so that the leat, entering through the higher north wall of the castle, filled all the reservoirs as it flowed down.

This was not the only water supply. From the eastern rampart, about halfway down its length and close to where two of the outer cisterns are scooped out of flat slabs of rock beneath the wall, a covered way dropped about 900 feet down to the river. Part of it still exists: it is 3 feet wide, covered in with arched masonry, very rough, about a foot thick, and ends at the water's edge in a tower 10 feet square. Both tower and passage are now filled in with earth, but no doubt they were built in rough steps, as the gradient of the hill is much too

steep for a path. The people of Shahristan have a curious tradition, and call this passage the Gurg-u-Mish, or Wolf-and-Ram. The rams, they told me, were put into the tunnel with skins of water tied under their bellies; the wolves were let in behind. Terrified by the pursuing wolves, and with no escape from the narrow way, the flock rushed up the slope and provided the castle with water. But it would need the imagination of a folk-lore expert to find the origin of this remarkable tale.

A man from Shahristan, who had given us figs on the way up, came and joined us as we sat over our samovar in one of the half-buried vaulted rooms. We could look out through its arched door into the hot daylight to the defile of the Nainarud, and beyond and above to villages in two green islands on the slope, and to the stony reaches of Gavanehkul, which lead to the Caspian. Another man soon dropped in from nowhere at all, and, sitting down in the friendly Eastern fashion, began to give at a great rate more information than we wanted. He told us that beyond those villages, in the lonely parts of the hills, is the Imamzadeh of Nur-Rashid, to which people make pilgrimages. These solitary shrines, now far from any habitation, usually point to localities once much more populous than now, and they are useful guides to the wandering historian.

Very little indeed is known about this country and there are many unidentified sites to be discovered in its recesses. The Dailamites were as strange as the Highlanders in their day to the more settled people of the plain. Their hostility, says Mustaufi, who must have heard a good deal about them, dates from those Sassanian days when Shapur had to bribe them to keep away from his city of Kazvin, which he was then beautifying. In Omeyad times, Muhammad, the son of Hajjaj, the famous governor, marched into the hills against them. From Dailam came the Buwayid princes who ruled the Moslem East during the tenth century. Their capital was called Rudbar, and the residence of the governors was called the Shahristan, and it is a reasonable conjecture that the name of Shahristan in the district of Rudbar may be the legacy of those times. I leave it to experts like Professor Minorsky to judge of these matters; but the modern Shahristan certainly holds a central position in the fertile valley, two days' journey from Kazvin, and with a great feeling of age about it and its castle.

When the Ismaili propaganda grew powerful and the Assassins established themselves in this country, they seem to have collected the Buwayid heritage and to have carried on the old feud against the Seljuks, making use no doubt of the tenacious loyalty of the hills. While the whole of the East was being devastated under the heel of the Mongols, while the cities of Merv and Balkh, Tus and Ray and Nishapur were so soaked in blood that they have never recovered, and the desert now covers their sown fields, the men of Rudbar still held this slanting hilltop, and looked out for six months over the heads of their enemies to the walnut trees of Shahristan and the Shah Rud in its valley beyond.

We left it and rode back across the ricefields and shallow downs to our Imamzadeh, and there found the headman of Shahristan and his Mirza waiting to call upon me. They were an amusing pair: one, a jovial middle-aged man of the world, rather loud in manner, and made more so in his appearance by

two bright red curls sticking straight out over each ear, while the hair on the top of his head retained its natural black; together with his very up-to-date European suit and watch and chain, this made him look more rakish than he intended. The Mirza was an Ascetic—one of those sad-faced Persians with tired eyes and gentle manners, pathetically thin, who spend their lives meditating inaccurately on abstruse subjects, and are roused to mild enthusiasm over beautiful and harmless things like calligraphy. Seated on the poor carpet in the hut, with the peasants at a respectful distance round, they cross-questioned me, the Squire doing the talking, but the Mirza, the Man of Learning, nodding his head over my answers and evidently giving the verdict as to whether my historical pretexts for travelling were to be taken as valid or not. The result was in my favour, and I have promised to visit the Squire of Shahristan again.

I now had trouble with Ismail. He had taken my guide aside and privately begged him not to mention any more castles, even if he knew of them, at any rate not in the district of the Shahrud and its mosquitoes. He would find me plenty of castles higher up, said he. I naturally resented this interference, having as a matter of fact just decided to travel down the valley and explore another site. But that night, lying out in the field under my mosquito net, I began to feel very ill. It seemed wiser to travel up towards Alamut and leave the river valley for a healthier season.

Next morning we retraced our steps, and reached again the bridge of Siah-dasht, but did not cross it, following the river instead, till we came to a desolate salt part of barren hills, where bitter undrinkable streams trickle down through the naked land—a god-forsaken region in which the path, hanging over the river, turned such difficult corners that our mules had to be unloaded and their packs taken round separately.

Then we came, on our left, to a series of red cliffs like sandstone, with no vegetation upon them. Fantastically heaped up, they continue as far as the headland of Shireh Kuh above us, and with it make the long winding defile for the Alamut stream. But here I was too ill to continue. We found a bridge in good repair, and crossed to the gentler side of the Shah Rud below the village of Kandichal; and seeing a little Imamzadeh in a small corrie, with a dell of fruit trees and a brook behind it, and three or four cornfields, I decided to camp in that solitary place. And it happened that, after a week's illness and the giving up of hope, I grew better and was able to continue my journey into the hills.

REVIEWS

EUROPE

ROMAN BRITAIN. By R. G. COLLINGWOOD. *Oxford: Clarendon Press* 1932. $7\frac{1}{2} \times 5$ *inches;* xii + 160 *pages; illustrations, plans, and map.* 6*s*

So much that is new in the lore of Roman Britain has come to light in the nine years since the author's book with the same title was published in the World's Manual series that it was thought well to expand and practically rewrite it. The result is an admirable manual for general readers well illustrated both pictorially and by way of fresh examples of broad principles. These are set out clearly and in good proportion. In particular we have a just estimate of the great extent to which Britons became Romanized in civilization, speech, patriotism, and sentiment, affording a marked contrast with most Roman provinces of the East. At the same time, it is made clear, they did not cease to be Britons. Mr. Collingwood deals with the conquest and occupation, town and country life, art and language, religion, and the end of Roman Britain. A full bibliography caters for the needs of readers who will wish for more detailed study. A useful end map marks the areas of dense and open woodland, and of land above 1000 feet. Among the illustrations are air views of Richborough and of the Folkestone villa, and an impressive picture of Roman London from the south-east, as reconstructed by the late Mr. A. Forestier. S. E. W.

THE PLACE-NAMES OF DEVON. By J. E. B. GOVER, A. MAWER, and F. M. STENTON. Part II. (English Place-Name Society, Volume IX.) *Cambridge: University Press* 1932. $9 \times 5\frac{1}{2}$ *inches;* xiv + 335 + 754 *pages.* 40*s* (*with Part I*)

Part I of 'The Place-Names of Devon' was noticed in the *Geographical Journal* for November 1931. It need not be said that vol. ix maintains the high standard of accuracy and interest which marks the series. The whole number of Devon names dealt with is about 7500, excluding field names, to which a section (pp. 689–692) is devoted. Addenda and Corrigenda to vols. i–ix will be found on pp. v–xiv. This volume treats of the Hundreds of South Molton, North Tawton, Witheridge, Crediton, West Budleigh, Wonford, Teignbridge, Exminster, Haytor, Bampton, Halberton, Hayridge, Cliston, East Budleigh, Ottery St. Mary, Hemyock, Colyton, and Axminster. A few random examples will illustrate difficulties that have to be overcome. Bridford (the ford either of birds or brides); Rackenford, possibly ford of the houses by the *raca* (path); Hemyock (perhaps from British *Samiāco*, possibly summer brook); Fingle derives from *fang* (hold, catch), and "might perhaps be used of a stream where there was a good prospect of a catch"; Clayhidon, perhaps hay hill, remarkable for its clay. The Quinta is an early example (1606) of the introduction of the Spanish *quinta* (country house). Meshaw, *mal-essart*, unfertile clearing. Many characteristic local pronunciations are recorded, helpful with such names as Woolfardisworthy. S. E. W.

THE NATURAL HISTORY OF WICKEN FEN. Edited by J. STANLEY GARDINER. *Cambridge: Bowes and Bowes* 1923–32. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 6 *parts,* xii + 652 *pages; illustrations and maps. Together* 25*s*

The present drainage scheme of East Anglia is a development of that which was begun in the time of the Commonwealth. One small area of about a square mile, cut off by the River Cam on one side and chalk ridges on the other, has remained

unaffected by these works, and Wicken Fen lies in this. It is now the property of the National Trust for places of Historic Interest or Natural Beauty, and surely fulfils both conditions embodied in the title of that organization. There can be no doubt that the old fens had a fauna and flora all their own, and Wicken as a relic persisting without break of continuity from pre-Roman times is of the greatest biological value. Rare marsh plants abound there and make life possible for a rich insect fauna, and thus it is that the fen offers its greatest attractions to botanists and entomologists.

It has been the aim of the editor and his contributing naturalists to lay the foundations of a long-continued ecological survey. A fine zoological census records the occurrence of more than two thousand species. Some of the changes in the fauna in historic times are known and the reasons for extension or diminution of range and for the disappearance of certain types are discussed. Botanical research has progressed rapidly, and in addition to a floral census there are essays dealing with communities, plant succession, and the effects of soil factors and water-levels on plant life. It is a rare thing to find a nature preserve with such an interesting historical background. It is rarer still to find a team of enthusiasts who will at the same time exploit the opportunities offered and ensure the perpetuation of an area secure from the noise of life. The editor and all those associated with him are to be congratulated on a finely sustained effort, and it is to be hoped that every encouragement will be given further to establish this unique National Park. L. E.

BRITISH TRADE AND INDUSTRY: past and future. By G. D. H. COLE. *London: Macmillan & Co.* 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xxiv+466 *pages; diagrams.* 16*s*

Mr. Cole has divided his survey of British industry and trade into four parts: an introduction, an outline history of British trade, post-War conditions (the longest section of the book, occupying nearly 300 pages), and a conclusion. He points out that he finished the book in August last year before the financial crisis. Perhaps it is unfortunate that he wrote a Preface to express his views on the present position, for most readers read a Preface first. In this case there are many who will be prejudiced against the book by the clear expressions of political opinion to which the author commits himself when he refers to his view that "the great extension of state control over the pricing system and probably over the productive as well as over the distributive trades is essential." The book deals more with foreign trade than with industry. The historical introduction is slight, for, as the author says, there are dozens of books dealing with this field, and he concentrates on the present position which is analysed with care and with the help of graphs and diagrams which will appeal to the geographical reader. Although the analysis of present conditions is made with academic fairness there is a political colour running through the book which leads one to anticipate the pro-Russian outburst on pp. 435 and 438. The author puts forward eight points which must be satisfied for the restitution of world prosperity; two of them demand that the world must come to terms with Russia and that there must be a large infusion of state socialism into the economic system of every important country. L. D. S.

THE STORY OF WINCHESTER. By W. LLOYD WOODLAND. *London: J. M. Dent & Sons* 1932. 7×4 *inches;* xvi+288 *pages; illustrations and plan* (by ADRIAN DE FRISTON). 5*s* 6*d*

This is an admirable account of a city history, which, especially in its early stages, is largely interwoven with the history of England. In spite of the destruction of monuments of the past by the Philistine authorities of the eighteenth century,

there is still much of interest left in Winchester, and the author has clearly and picturesquely described many of the stirring scenes of which the ancient city has been a witness. He takes us from the days of the Early Iron Age hilltop fort on St. Catharine's Hill, which was probably constructed in the fourth century B.C., through the times of the Belgae, and the Roman invasion and occupation, lasting for the best part of four hundred years, to the vague and uncertain early Saxon settlement, to more solid history in the time of Cynegils, and on to the reigns of Alfred, Canute, the Conqueror, and the Norman kings. He describes the Winton Domesday; the struggle between Stephen and Matilda and the sieges of the western castle; the foundation of the Hospital of St. Cross; and so on to the Black Death, the opening of Wykeham's College on 28 March 1393, noting that a copy of this College was founded by Henry VI at Eton; then we have the "Ancient Usages of Winchester," giving much information about the life of the citizens in the Middle Ages.

There are accounts of the secular quarrels between the monks and the laity; the ebb and flow of the Great Rebellion and more sieges; the Battle of Cheriton, a few miles off, which so injured the King's prospects; the revival of the city in the reign of Charles II; the complacent eighteenth century; the agricultural revolt of the early nineteenth, and its brutal suppression. Much else will be found in this attractive and handy little book, which gives us clear pictures of the passage of a section of wayward and stumbling humanity through the last two thousand years, as illustrated by the history of one of the most interesting cities in the country.

In the next edition, which is sure to be called for, a few corrections and additions might be made. The 6-inch map at the end of the book would be more useful if it had a scale. An index to the book would be helpful. And it might be as well to give a list of the original authorities. On p. 124 Prior Silkstede's pulpit is stated to have been erected in 1620; the date should, of course, be a century earlier. The earthwork to the south-west of the city, now known as Oliver's Battery, was not, as stated on p. 196, thrown up by Hopton during the Civil War, but is certainly older than the seventh century A.D., and is probably Roman in origin. However these are not very important matters, and the book may be unreservedly recommended as a compact and eminently readable history of the old capital of England. C. F. C.

WATER AND GRASS: a study in the pastoral economy of Southern Europe. By E. H. CARRIER. *London: Christophers* 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+434 *pages.* 21*s*

Among the effects of the past intensive glaciation of the Alpine chains of Europe the resultant mountain pastures are of much geographical interest. During a brief period they yield highly nutritious fodder for stock animals, while for the rest of the year they are unsuited either for man or for his flocks. Thus they present at once an economic resource and a problem—a problem because the animals which feed there in summer must be provided for throughout the rest of the year, a resource since their use does not involve the withdrawal of land capable of yielding direct food-crops. Within the circuit of the Mediterranean Lands the problem appears to be somewhat simpler than outside. There the climate permits of the growth of natural grass on the lowlands during the winter months, and, particularly when fallowing was the chief means of restoring fertility to cropped lands, alternating seasonal migrations from high pastures to low appeared the natural response to the conditions. Improved agricultural methods, increased density of settlement at the lower levels, and other causes, social, economic, and political, have affected in the past and are still affecting

what appears at first sight a simple relation, and have led to a whole series of changes and complexities. Miss Carrier's is, we believe, the first English book dealing with the general subject of transhumance as it exists at the present day in parts of Europe, and with the historical modifications which it has undergone. Since it is a thorough and conscientious piece of work, it thus constitutes an important addition to geographical literature.

Its scope is in part somewhat wider than the sub-title would suggest, for in addition to Spain, Italy, the Balkan Peninsula, the Swiss Alps, and the French Alps with their Borderlands, the conditions in the Central Plateau of France are also considered. Much of the voluminous French literature on the general subject has been summarized, and French authors bulk largely in the lengthy bibliography. Switzerland, apart from the particular case of the Val d'Anniviers, is somewhat less fully treated, and the French standpoint predominates over the Swiss. But it must be admitted that apart from Canton Valais, where the climate shows some "Mediterranean" affinities, conditions in Switzerland generally differ in many respects from those of Southern Europe proper.

In addition to an index of place-names there is one of pastoral terms, an exceedingly useful adjunct since these show such wide local variations. Finally, some general chapters, especially those on "Shepherds' Tales" and "Times and Seasons," lighten the contents and make a wider appeal then the purely technical one. Some of the legends mentioned are delightful. What fitter penalty could be imposed on a dishonest pastoralist than the task of striving throughout eternity to make cheese from "glacier milk"? M. I. N.

EUROPE CENTRALE. By EMM. DE MARTONNE. Deuxième partie. Suisse—Autriche—Hongrie—Tchéchoslovaquie—Pologne—Roumanie. (Géographie Universelle. Edited by P. VIDAL DE LA BLACHE and L. GALLOIS. Tome IV.) *Paris: Armand Colin* 1931. 11½×8 *inches;* 381–845 *pages; illustrations and maps.* 120*f.*

Professor de Martonne's masterly survey of the geography of Central Europe, the two parts forming the fourth volume of the 'Géographie Universelle,' is now complete, and the result can be appreciated as a whole. Without question, it must take rank as the definitive standard work on the subject, and when placed beside the eminent author's 'Traité de Géographie Physique' indicates him as among the most able, the most lucid, the most convincing, exponents of geography that the present century has produced. The reflections of an English reviewer when handling these splendid volumes cannot be happy ones. Here are 845 flawlessly printed pages, enriched with four double-page maps in colour, 136 really beautiful photogravure plates, and 187 illuminating text-figures the execution of which leaves nothing to be desired, the whole at the low price of 230 francs. Where is the English publisher, the English printer, the English draughtsman and block-maker who could produce such a work at such a price? And, more important still, where is the English geographer who could match M. de Martonne in range of knowledge combined with power of geographical synthesis?

It is the contention of some, who seek to perpetuate the *status quo*, that "regional synthesis" is a high-sounding but empty phrase, that there is no superstructure of geography to be raised upon the foundation of exploration and survey. Let these read 'Europe Centrale' and think again. Quotations may be taken almost at random: "C'est à l'Est de l'Enns qu'apparaît toute la richesse de l'Autriche subalpine, où les Alpes prennent contact avec le monde hercynien. La zone tertaire est réduite à une serie de petits bassins, aux rivières bordées de terrasses, si bien abrités que le climat y prend une teinte continentale accusée, avec des

pluies inférieures à 60 centimetres, des hivers assez froids, mais de chauds et lumineux étés (moyenne de juillet, 18·5° à Sankt Pölten). Les cultures s'y étalent sur le loess, qui recouvre les terrasses inférieures: elles montent même sur les flancs des derniers chaînons de flysch subalpins, quand les bois n'y ont pas été protégés contre la colonisation médiévale par l'existence de grands domaines princiers, comme dans le Wienerwald. Les îlots du Massif Bohémien, détachés par les gorges épigéniques du Danube, se dressent comme des bastions forestiers; mais la vallée du grand fleuve, burinée dans le granite, est loin d'être toujours un défilé sauvage. Les étapes du creusement y sont marquées par des terrasses, parfois recouvertes de loess. L'homme y a été attiré par ces replats, où prospèrent les cultures riches, par les facilités de passage du courant fluvial, resserré entre des berges rocheuses où les barques peuvent accoster facilement " (p. 481). Here the significance of the physical history, equally with the human history, of the region in impressing a geographical individuality upon the Lower Austrian Corridor is clearly brought out without an illegitimate labouring of "principles of causation," and present-day human distributions are sharply illuminated. One is tempted to quote again and again. Note, for example, with what masterly economy of words the subtle variety within the broad monotony of the Alfoeld landscape is brought before the reader (p. 516), and note too, on the opposite page, the effectiveness of the system of conventions employed upon the morphological maps, of which those of the Hungarian Plain and of the Dobrogea (p. 783) are among the more striking examples.

Having completed his synthetic treatment of each of the Central European States, region by region, M. de Martonne is not afraid of drawing some general conclusions, for "La géographie a son mot à dire pour expliquer cette situation troublée, et peut-être ouvrir sur l'avenir quelques aperçue." Central Europe is essentially isthmian in character, a constricted belt between the Mediterranean and Baltic Seas, a corridor linking the vast plains of Russia and Asia with the Atlantic Margins. Within the limits of this isthmus the three structural belts—Tertiary fold mountains, Hercynian blocks, Glaciated plains—are crowded together and produce great diversity of *milieu* within small compass. Among the three it is the Hercynian zone that has played the master role, its vast forests serving to check the penetration of Mediterranean civilizations in the distant past, its mineral wealth serving increasingly since mediaeval days to form the basis of a very localized industrial and urban life. But this zone has its maximum development in the west of Central Europe, where, too, it is trenched from south to north by the Rhine corridor. Hence the striking contrast, the steep economic gradient, as de Martonne terms it, between the highly industrialized Rhine lands, with a huge urban and proletarian population at one extremity of the region, and the purely agricultural Lower Danubian lands at the other, with a dispersed peasant population the rhythm of whose life is determined by seedtime and harvest, by rainfall and drought. Such a gradient implies conflicting interests, conflicting aims, conflicting lines of social and political thought, and hence is a menace to peace. Within the individual States, too, similar gradients, creating similar tensions, are to be found, as between Vienna and the Tyrol, Polish Silesia and the Wilno region, Bohemia and Slovakia. In Hungary and Romania the contrasts are less sharp, but only because of the relative absence of industrial and urban development. In Germany they are present, but have been "rationalized" by the activity of circulation, thus becoming an element of enrichment of the national life rather than a source of tension, and this is the solution that must be sought elsewhere. Nevertheless, "la structure d'Allemagne implique une sorte de surtension commerciale qui rend cet organisme économique vigoureux particulièrement sensible et, à certains égards, vulnérable. . . . Une

sorte de vertige économique entraîne l'Allemagne aux réalisations les plus audacieuses, pouvant conduire, en période de crise, au vertige politique. Plus l'organisme est vigoureux, plus la fièvre qui se declare peut être violente, et plus les réactions sont à craindre."

In the midst of those States which the far-reaching changes of the last twenty years have left in a condition of political, and above all economic, tension, menacing alike to their external and their internal quiet, Central Europe can yet show us also "la petite Suisse," as a sort of ideal example, proving (says M. de Martonne) that nothing is impossible to the human spirit rightly directed, that diversities of race, language, and religion, of physical and social *milieu*, are not incompatible with unity. Nevertheless, even Switzerland has not passed through the war and post-war decades economically unscathed, and indeed throughout Central Europe to-day, now that the national tensions have been more or less resolved by the new frontiers, it is the economic problem that imperatively demands solution. "Le géographe décrivant l'Europe centrale après le premier quart du XX^{e} siècle a conscience de se pencher sur un point de notre Terre méritant tout ce que l'effort des savants a accumulé d'études de tout genre. Ce territoire est de ceux sur lesquels on ne projettera jamais trop de lumière. . . ." Within the British Isles, and within the British Empire, there are also economic gradients dangerously steep, economic tensions that must be resolved. A geographical synthesis of the relevant physical, historical, and human factors in the situation would serve to bring these problems clearly into focus.

E. G. R. T

JENSEITS DER GROSSMÄCHTE. Edited by KARL HAUSHOFER. (Ergänzungsband zur Neubearbeitung der Grossmächte Rudolf Kjelléns.) *Leipzig: B. G. Teubner* 1932. 8½×5½ *inches;* vi+520 *pages; diagrams and sketch-maps. M.*13.50 (*Unbound M.*11.70)

The volume of Kjellen's to which this is supplementary was noticed in the *Journal*, vol. 75, p. 79. The present work, being more diffuse, lacks the unity of the former, wherein each state was treated as an organism. Its subject-matter is the political geography of the lesser European Powers, Africa, the Near East, and Australasia. It is frankly designed to present a "Germanic" point of view, especially in contradistinction to works such as those of Bowman and de Martonne. The geographical discussions of political and economic inter-relations, if this object is kept in view, are enlightening. Much space is filled with essays on the various movements towards the evolution of larger units—Pan-American, Pan-European, and the like. It is interesting to note that one writer believes that "Pan-Europe" can be achieved only through a "Pan-Central-Europe"; and another long chapter urges the instability of conditions in the latter area.

G. R. C.

DÉMOCARTOGRAPHIE DE LA FRANCE. I. Des origines à nos jours. By CHARLES DU BUS. *Paris: Félix Alcan* 1931. 10×6½ *inches;* xiv+206 *pages;* 50 *fr*

The greater part of this volume, pp. 63–200, is occupied by classified lists of 1370 demographic maps which refer to France, with brief notes on each to indicate the area and topic it deals with, the method of representation used, and the place and date of its publication. The preface contains a closely printed bibliography, occupying four and a half pages, of the works used in compiling these lists. Two further volumes and an atlas are promised to complete the work. The text is made up of a brief account of the development of statistical maps in several departments of the French Government, and a chapter of full notes on the various

scales and methods of representation which have been employed in the maps listed. Thus the book has a double value as first, a comprehensive guide to its subject matter, and second, a summary record of methods and experiments in the representation of demographic statistics. C. B. F.

LANDESKUNDE VON DEUTSCHLAND. Edited by N. KREBS. Band II. Der Nordosten. By BERNHARD BRANDT. *Leipzig: B. G. Teubner* 1931. 9×6 *inches;* 148 *pages; illustrations and maps. M.*8 (*unbound M.*6.40)

This book deals with the north-east geographical province of Germany. Tracing first the evolutionary processes, geological and physical, which have affected the region, the author leads on gradually to the human period, after which the successive stages of occupation and development follow in due course. Mention is made in the foreword of the difficulties attending such a work, more particularly in a region which, unlike the mountainous south, is not parcelled out into distinct areas; where, moreover, the formative processes have been more fluctuating and their historical sequence less clearly defined.

The work is divided into two parts: (i) general, (ii) special. The general part describes the position and boundaries of North-East Germany, its divisions and superficial character, the drainage net and denudation; the climate, fauna and flora; types of human settlement with the resulting industries and methods of intercommunication, etc. In connection with the superficial character it may be mentioned that the southern or outer Baltic ridge is not the generally accepted boundary of the last ice-sheet. The special part deals with the various members of the region more in detail. For the purpose of this description the mountain rim embracing the level or lowlying areas is separated into five parts, the more level country to the north being dealt with in five divisions also. This part of the work, besides furnishing much needful information for the student, affords suggestions as to lines of future research. In particular the author mentions types of villages and of architectural form as determined in their distribution by the nature of the soil, the tribal origin of the inhabitants, availability or scarcity of certain materials and many other contributary factors.

The photographs and maps in this part of the work are excellent, but a key-map showing relative positions and relationships is needed. The bibliography is adequate and far-reaching, but there is no index. E. G. W.

ON THE ROADS FROM ROME. By LUIGI VILLARI. *London: Alexander Maclehose & Co.* 1932. 9×5½ *inches;* xii+296 *pages; illustrations and sketch-map.* 12*s* 6*d*

The most valuable portion of this readable book is the description of farm life on the Campagna in the days now rapidly passing before the highly efficient reclamation works inspired by the energy of the Fascist régime. Of the advantage for the farm hands and for Italy as a whole there can be no doubt, heavy though the loss may be to the lover of the picturesque and of the wild beauty of this malaria-stricken region. This life Signor Villari has long known intimately. He has many friends among the farm bailiffs and has kept a horse on the Campagna for years; and what more ideal country for riding could one find in Italy? Hardly less interesting are his descriptions of his favourite routes from Rome, including the villages, castles, and Roman and other ruins. He makes no attempt to give more than a general sketch of the Campagna as a whole, for naturally his method of exploration limits his field. But if the motorist covers a larger one, he is confined to the few good roads and he forfeits the intimacy of Signor Villari's knowledge. A mounted man can ride with the herdsmen of horses and cattle, and there can

be very little of the farm life that has escaped our author. He gives us good descriptions of the wonderful transformation that is once more making the Campagna a prosperous agricultural district, but of this we have already had accounts in English. L. C.-M.

ASIA

THE MONGOLIAN HORDE. By ROLAND STRASSER. Translated from the German by R. T. G. *London: Jonathan Cape* 1930. 9×6 *inches;* 346 *pages; illustrations.* 12*s* 6*d*

This is a kind of book which it is difficult to review because it is difficult to classify. It can hardly be called a travel book as the author is coy to the point of reticence about his movements, makes no mention of how or where he went, ignores dates, provides no map, and so it is only from Sir Michael Sadleir's foreword that we get any clue to the route. Then again the book, with its long and often rather tedious dissertations on Lamaism and its kindred creeds, might be a work of a semi-religious character, were it not impossible to discover how much the arguments about these casual creeds are the theory of the author or the dogmas of the believers. As a general and up-to-date description of Mongolia the book might be welcomed, but here also there is a vagueness and discursiveness that diminish its historical value, in spite of much that is remarkable and unusual. Thus it is that a reviewer may be pardoned if he is unable to place the book in a particular category.

The book however is far from being uninteresting, for the author, though often turgid and obscure in his meaning, has real descriptive powers. This is seen in the accounts of Urga (pp. 95–96) (though the story of Baron Ungarn Sternberg on p. 100 is inaccurate, see the *Atlantic Monthly*, March 1930, p. 376), of the Asiatic Jack-in-office (pp. 118–119), of the sudden storm (p. 132), and of Feng Yu Hsiang (*sic*) on pp. 280, 281, which are all examples of brilliant and incisive description. Presumably not all the accounts in the book are meant to be first-hand, *e.g.* that of the dead Mongol on p. 167, but the story is terribly vivid and repellent. Certain passages indeed might have been omitted with no loss to the narrative, but that is the author's concern.

The spelling of many words is open to criticism, *e.g.* Daravish for Tovarish (pp. 270–271), Geluppa for Gelugpa (p. 239), and a few others; but there is no excuse for the translator, who has done his work extremely well, writing jurt for yurt, chan for k'ang, and Tali-lama for Dalai Lama, as these words are now naturalized in English, certainly in works on Central Asia. It is impossible however to lay down this book without a sigh of regret, for the writer has missed a chance of producing a valuable work on a very little-known and rapidly changing country, but it is to be feared that as now compiled the book has slight value as a work of reference. R. C. F. S.

GOVERNMENT OF EL 'IRAQ. An Inquiry into Land Tenure and related questions. Proposals for the Initiation of Reform. By Sir ERNEST DOWSON. *Baghdad: Ministry of Finance* (1931). 13×8 *inches;* 78 *pages; maps. Rs.*3 (*or* 4*s* 6*d*)

In this Report Sir Ernest Dowson presents the results of the inquiry which he was invited by the Government of El 'Iraq to undertake in 1929. The author aptly describes the country "as being in the position of an old estate, previously rich, still very valuable potentially, but now derelict through long bad management, accentuated by changing needs and progress elsewhere."

The problem to be tackled was (*a*) the settlement of rights to land throughout

the country; (*b*) the establishment of an efficient land register; (*c*) the unification of disconnected Departmental efforts. Solution of the problem was greatly complicated by the fact that tenure of some four-fifths of the cultivated land was not governed by law or any method, while the land law was defective and uncertain in its application to the other fifth. There was also an almost complete lack of reliable information at headquarters with regard to land conditions generally. The author therefore set out to obtain the information himself, and as a result of laborious inquiry and much visiting and investigation on the spot, he gives in Parts I to IV of his Report a clear and concise statement of existing conditions with regard to cultivation, population, survey, and land tenure. In the remaining Parts V to IX he gives his recommendations for dealing with the situation.

The account in Parts III and IV of the existing law and conditions of land tenure shows them to be of a somewhat bewildering complexity. The foundations of the present land laws are to be found in Turkish legislation, though this has been greatly altered and largely disregarded. Broadly speaking, if the small amount of privately owned land (Mulk), mostly in towns, be disregarded, the basic idea is that all land is the property of the State. Some is granted out on a form of registered tenure (Tapu) which is permanent; and the remainder, except for Matruka, or land reserved for public use, is Miri land, the tenure of which is governed by no law, but by an infinite variety of custom and practice. While Tapu land is ostensibly held on a registered tenure, the Register is unsystematic, incomplete, and generally unreliable as a register of property. Miri land, on the other hand, is held by right of pasturage, cultivation, occupation, or similar claim. The rights are in some cases well founded, in others very doubtful, and nearly always complicated by counterclaims or other difficulties. "Broadly speaking, those who occupy and cultivate miri land are allowed to do so in the absence of more influential opposition . . . but neither long possession nor any other mode of acquisition confers security." Numerous attempts to put the tenure of land on a more satisfactory basis have been made, by the Turks, it may be mentioned, as well as by others. The failure of the Ottoman land laws was due largely to lack of an efficient administration to carry them out. The failure of more recent attempts is due to the fact that, though good in themselves, they were all detached and isolated local efforts.

While recognizing the great complexity of the problem, and the many difficulties and dangers which will be encountered, Sir Ernest is convinced that effective reform of land tenure throughout the country is possible, and that the difficulties "will yield, as they have done elsewhere, to intelligent, sincere, and persevering attack." The measures that he advocates for the execution of reform (as distinct from its conservation later) are (1) study and revision of the land law, (2) completion of the topo-cadastral survey, (3) systematic valuation of the land for revenue purposes, and (4) general settlement of rights to land. In each case he goes into details, and makes definite and practical proposals. With regard to land law, he recommends that two competent officers should be nominated to prepare a statement of the land law, and to make recommendations for its amendment, as was done in Palestine in 1927.

In the matter of survey, Sir Ernest, as a former Surveyor-General, speaks with special knowledge. He notes that, while the Survey Department is rightly recognized as a scientific service, "its importance as an agent of economic progress appears to be insufficiently appreciated." Survey in the country is behindhand, though much good work has been done Sir Ernest points out that an adequate survey is the essential foundation for an efficient system of land registration; but he recognizes that to carry out a large-scale detailed cadastral survey is impracticable, if the survey is to be of use in reasonable time for the purposes of the reforms

he advocates. He therefore recommends the continuance of the 1/10,000 survey already partly done, in the form of a "topo-cadastral" survey. One of the chief obstacles with which the survey has had to contend in the past has been uncertainty of programme and the frequent diversion of surveyors to meet scattered demands elsewhere. He recommends additions to staff, adherence to a regular programme, and concentration of all survey work under the technical head of that service. His remarks on the need for a sound and accurate basis for survey, for continuity, and for provision for maintenance, are all worthy of attention.

Settlement of rights to land he considers should be undertaken on a systematic programme, "to be effected methodically, parcel by parcel, until work has been completed throughout the territory to be dealt with." This work he suggests should be done by Administrative Inspectors, these officers being in every way fitted for the work by their long experience of the country, and their knowledge of its inhabitants, language, laws, and customs. The compilation of a proper Land Register would proceed concurrently with the land settlement. Valuation, on the other hand, he considers need not wait for settlement, but could proceed independently, subject only to the completion, in the region concerned, of the detail survey, as a general control of the areas. With the object of getting taxation on to a better basis throughout the country with the utmost despatch, he recommends a bold policy of averaging of value throughout each unit of the survey, considering that the imperfections of such a method would be outweighed by the solid improvement attainable for the nation at large within the shortest possible period.

Finally, the author points out that the failure of successive governments to carry out the necessary reforms is due to the lack of a competent executive authority responsible for the study and supervision of the reforms. For want of this central authority, charged with this definite duty, a vast amount of energy has in the past been dissipated in interdepartmental discussions. He advocates therefore the establishment of a Central Lands Office, and he defines its functions.

The chief impression left by the study of this Report is one of admiration for the masterly manner in which the author has dealt with a problem of great complexity, not only in presenting that problem, but in the exceedingly sound and practical measures which he advocates to bring about the desired reforms. In his covering letter, Sir Ernest states that he considered it essential, if he were to carry out his task properly, that he should fulfil two requirements: he must present the problem comprehensively, and he must formulate proposals which were practicable and within the resources of the country. It is obvious that he has kept these two governing considerations before him throughout the Report, and in the opinion of the writer he has fulfilled them admirably. The carrying out of these reforms must clearly be a long and a difficult business. But if the task is tackled by the Government resolutely, and carried out patiently, persistently, and justly, there will be few who will doubt that it will be ultimately successful, and that it will do much towards restoring this ancient country to its former prosperity. E. M. J.

AN ACCOUNT OF TIBET: the travels of Ippolito Desideri of Pistoia, S.J., 1712–1727. Edited by FILIPPO DE FILIPPI. (The Broadway Travellers. Edited by Sir E. DENISON ROSS and EILEEN POWER.) *London: George Routledge & Sons* 1932. 9×5½ *inches;* xviii+474 *pages; illustrations and map.* 25*s*

Prior to 1875 practically the only document from which Desideri's travels were known to us was his letter to Fr. Ildebrando Grassi, written from Lhasa in April 1718, which was published, with other letters about the Tibet mission, in Rome in 1728, and afterwards republished in other countries. In 1875 a bulky MS. in

Italian of the 'Relazione' was found at Pistoia by Professor Carlo Puini, the greater part of which was published by him in 1904 in the *Memorie Soc. Geogr. Ital.* This important discovery had been reported meanwhile by Yule to C. R. Markham, who referred to it in 1876 and suggested that the Italian edition "ought to be promptly followed by an English edition." While Cav. F. De Filippi was engaged in preparing an English translation, supplementing Puini's text from the Pistoia MS. and bringing the notes up to date, he found from Fr. Wessels's scholarly work on 'Early Jesuit Travellers in Central Asia' that two other MSS. of Desideri's narrative were in possession of the Society of Jesus. He has now collated all three MSS. and, with some rearrangement of the matter, has presented in the volume before us an almost complete edition. Some passages and chapters dealing with purely missionary topics have been curtailed or omitted, but all that is of general interest in the MSS. has been retained; and it is one of the most valuable documents of all those which we owe to the indefatigable zeal and fortitude of Christian missionaries, so often the pioneers of discovery.

After a bibliography of Desideri, we find an excellent historical survey of the Jesuit Mission in Tibet from 1625 to 1721 by Fr. Wessels and an informing preface by the editor. Then comes the text of the narrative (some 300 pages), appended to which is a complete English translation of the only known copy (in Latin) of the Report by Fr. Emanoel Freyre, who accompanied Desideri to Lhasa, now published for the first time. Next we have abundant and helpful notes elucidating obscure references and names in the text, and two full indexes, the one general, the other of Tibetan words. The illustrations have been well selected.

Book I describes the journey to India and on through Kashmir, Ladakh, and Tibet to Lhasa, and the reception and work in that city. Book II contains a general account of Tibet, its provinces and government, and the life and customs of the people. Book III, where we come to the pith, gives a remarkable exposition of the religion and hierarchical organization. In Book IV Desideri tells us how he received the decree granting to the Capuchin fathers the exclusive right to the mission, of his departure from Lhasa and return to India *via* Nepal, and his long voyage home. Desideri gives us the earliest full and reliable account of Tibet generally and of the lamaistic religion and practices in particular. His critical and discerning description of Lamaism, based upon intensive study of the canonical literature and constant intercourse and discussion with those best qualified to interpret it, is of the utmost value to the student of comparative religion. We miss however reference to survivals of the Bon (Pön) or old shamanistic beliefs of the land, the undercurrent of which has always continued to flow. The assiduity with which Desideri strove to equip himself for this study and criticism by mastering the language, both spoken and written (four lengthy MSS. written by him in Tibetan are extant) reminds us of his great fellow-countryman, Roberto de Nobili, who, a century earlier, at Madura in Southern India, by his mastery of Sanskrit and Tamil and sanctity of life, acquired an influence in his sphere of work unequalled perhaps before or since.

From an historical point of view the most striking part of the narrative refers to the events, of which he was an eye-witness, following the action of the Mongol regent Latsang Khan (whom he calls Cinghes Khang) to get rid of the dissolute 6th Dalai Lama, the Oelöt invasion of 1717, and the ultimate reconquest of the city and country by the Chinese in 1720. Hitherto we have been chiefly dependent upon Giorgi's 'Alphabetum' for an account of this crisis in Tibetan history. Many other items of historical interest may also be gleaned from the 'Relazione.'

A special geographical interest attaches to Desideri's narrative from the fact

that he and his companion, Fr. Freyre, were the first Europeans to travel from Leh up the valley of the Indus to the vicinity of Mount Kailas and, passing Lake Manasarovar, down the valley of the Tsanpo to Lhasa. This remarkable journey, the hardships of which may well be imagined, occupied ten months, and most probably could never have been accomplished but for the chivalrous kindness of a Mongol lady, the widow of the late "governor," who was travelling from Tashigong to Lhasa and who, "because of the Conchoquo" (the Buddhist triad), as Freyre tells us, took the two ill-equipped fathers under her escort and care. Unfortunately the geographical information recorded by the fathers, whose minds were absorbed in matters religious, is most disappointingly meagre, but the mention of the following places passed on the way leaves no doubt as to the general line of route: "Lhe otherwise Lhatà" (Leh or Ladakh), Trescij-Khang (Tashigong), Cartoa (Gartok), the highest point in the desert of Ngnari-Giongar (*i.e.* the Jerko La, 16,200 feet, in Ngari Khorsum or Hundes), "a plain called Retoa, where there is a lake so large that it takes people several days to walk round . . . believed to be the source of the Ganges (Lake Manasarovar), Serkia or Serchia (Saka Dzong), Secchia (Sakya Dzong), and Giegazzè (Shigatse)."

We may note that *Parvatiya* (p. 319) does not mean "inhabitants of Bettiah," but "hill (*parvat*) folk," and *Bajahra* (D.'s "Bazzarà," p. 332) should read *bajrā*. *Ol* (p. 319) is evidently the Kumaoni word *ol*, meaning "fever," which is *aul* in Nepali. The reference to the Meoras on p. 325 is interesting. This name, derived from a people (Mewāṭīs) employed as runners or messengers on account of their endurance, is very rarely met with, but they are mentioned in the 'Ain-i-Akbar' as being employed under the Mughal Government.

English-speaking people should be grateful for this admirably edited volume. There will no longer be any excuse for the ignorance and misconceptions regarding Desideri, to which Fr. Wessels and Cav. De Filippi have drawn such pointed attention. C. E. A. W. O.

THE MANCHURIA YEAR BOOK, 1931. *Tokyo: Toa-Keizai Chosakyoku (East-Asiatic Economic Investigation Bureau)* 1931. 9×6 *inches;* xii+348 *pages; illustrations and maps*

The East Asiatic Investigation Bureau is fully justified in the satisfaction the preface to this work expresses at the synchronization of publication with widespread interest in Manchurian affairs. It is also entitled to a generous measure of praise for having provided something which was badly needed, a volume bringing together in manageable size a great variety of material necessary to correct appreciation of Manchurian issues, yet hitherto scattered and difficult of access. The book specializes moreover in the least-known aspects of the Manchurian problem—administration, railways, mines, finance, and trade—dealing comparatively briefly with politics and history, upon which the general reader was already fairly well provided with books. Of the twenty-one chapters which the volume contains seventeen deal with what he is apt to regard as the dry bones of the subject until he discovers how necessary familiarity with them really is. Few of Japan's rights in Manchuria, for instance, can be properly understood without reference to railway lines and the economic needs which they are designed to serve. Indeed, the Fushun coal mine—one of the largest single deposits in the world—contains more of the truth about Manchuria than any other of the component factors of the Manchurian problem.

It is in the elemental character of this fact—its crudity, if that term is preferred—that the strength of Japan's case in Manchuria lies. And in so far as this book was intended to be a presentation of her case—at once an obvious and a legitimate purpose, amongst others, of its compilation—it is a pity that the historical

chapter does not face realities more openly. As written, more because of what it does not, than what it does say, it strikes a propagandist note, whereas Japan's case requires no such aid. To say that is neither to ignore nor to belittle the strength of China's case. Still less does it imply any under-valuation of the world's case as represented by the League of Nations. It means no more, yet no less, than this, that the Japanese can justify their action in Manchuria by reference to some of the simplest and, at the same time, most compelling facts in the whole range of international affairs, those of self-preservation.

It is also a pity that the elaborate trade statistics given in Chapter XV should be rendered misleading, so far as the British figures are concerned, by inaccurate classification. Imports into Manchuria are credited to Great Britain which should have been credited to India and other parts of the British Empire, the result being that the total of this country's trade with Manchuria is quite unreliable. When a reviewer, competent to make that criticism, feels obliged to make it, he naturally feels doubt as to the reliability of other statistics upon which he is not in a position to pronounce. E. M. G.

RUSSIA AND THE SOVIET UNION IN THE FAR EAST. By VIKTOR A. YAKHONTOFF. *London: George Allen & Unwin* 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xxii + 454 *pages; maps.* 18*s*

This book is of political rather than geographical interest. It deals mainly with the relations of China to Japan and Russia, which are traced from their beginnings. The development of the situation in China since the inauguration of the Republic is described in considerable detail. The texts of the most important international instruments to which Russia has been a party are given in appendices. It is claimed that the secret Sino-Russian Treaty of 1896 is published in full for the first time, and that other documents have not hitherto been available in English. Unfortunately this is clearly not the author's native language, with the result that the style is often tedious and obscure, while the arrangement of the book leads to rather frequent repetitions.

Mr. Yakhontoff says he "has had considerable experience in the Far East, both under the Russian Imperial régime and later, and has devoted long years of work and study to conditions in China, Japan, and the Asiatic possessions of Russia." He has also lectured on "Oriental topics" in the United States. His sympathies lie with the point of view of the left wing of the Kuo-min-tan. He has little good to say of the "imperialist" powers, and the trend of his conclusions is to show that Russia should be able to play the part of a disinterested friend to China, since she is not a competitor in the Pacific world either for an outlet for surplus population or for raw materials and markets. Few people are likely to accept so ingenuous an interpretation of Soviet policy in the Far East.

The system of numbering the footnotes separately for each section of a chapter is confusing. The maps are inadequate, both for illustrating the treaties and for following the development of railway construction, particularly in Manchuria. J. DE V. L.

FUJIYAMA. Special Edition limited to fifty copies. *Tokyo: Japanese Alpine Club* 1931. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches;* 272 *pages; illustrations*

This handsome and interesting volume is issued in commemoration of the twenty-fifth anniversary of the foundation of the Japanese Alpine Club. In order justly to appreciate the special features of a work of this character we need to remind ourselves that for the Japanese people Fuji-San is not merely a mountain-peak, however striking in situation and beautiful in form. It stands for them as a symbol of all that is most noble, gracious, and inspiring in nature,

and as such it forms the favourite subject in the arts and crafts of a lively and impressionable people.

Quite apart however from the aesthetic aspects of this volume, many of the subjects with which it deals—and they are both numerous and varied—are of great scientific value. For the first time in its history we have the famous volcano photographed from every conceivable point of view, whether land, sea, or air; many surprising and sometimes unsuspected aspects are revealed. It is displayed before us at every season of the year and under almost all known atmospheric conditions.

Among the varied collection of photographs are a series which illustrate different forms of "bombs" and other volcanic *ejectamenta*, together with the peculiar character of the weathering to which they have been subjected. Several views of unusual interest display the results of the downflow of the great lava-stream which once descended from the main crater of the mountain on the north and west; it was finally dammed up against the outer flanks of the granite hills that hem in the southern portion of the fertile plain of central Kōshu.

Here we are shown the chain of lovely lakes which now lie in the hollows formed at the points of contact between the extreme edge of the lava-stream and the opposing granite barrier. Their waters maintain a uniform level in a manner which seems to indicate a subterranean connection throughout their entire length.

The varied forms of vegetation occurring on Fuji-San are fully illustrated by numerous photographs particularly interesting because names held in high honour in the past of our Society have been connected with the discovery of some of the most interesting varieties. W. W.

JOURNAL OF FRANCIS BUCHANAN, kept during the survey of the district of Bhagalpur in 1810–1811. Edited by C. E. A. W. OLDHAM. *Patna: Superintendent, Government Printing, Bihar and Orissa* 1930. 10×6½ *inches;* xxxii+260+x *pages; maps. Rs.*2.8

The reports in which Dr. Francis Buchanan embodied the results of his statistical survey of Bengal and Bihar in 1807–15 remain for the most part still in manuscript; and in these days, when rigid economy is being enforced in certain directions, there seems to be little hope that the valuable information they contain will be made available. Fortunately however three of the journals kept by Buchanan during his investigations have also survived; and these, as being of more manageable bulk, have now all been published in turn by the Government of Bihar and Orissa. One of them, relating to Patna and Gaya districts, was issued about seven years ago under the editorship of the late Mr. Jackson; a second, dealing with the district of Shahabad, appeared soon afterwards, under the care of Mr. Oldham; and now the third, narrating the survey of the Bhagalpur district during the cold weather of 1810–11, and edited likewise by Mr. Oldham, lies before us.

As the editor reminds us in his excellent introduction, in Buchanan's time the district of Bhagalpur comprised not only more than half of the present district of that name, but the greater part of the modern districts of Monghyr and the Santal Parganas as well, and covered an area of 8225 square miles (rather more than half the size of Switzerland). It was a region of peculiar interest, not only on account of its diversity of natural features, but also from its historical associations and from the points of view of ethnology and linguistics. On the north it bordered upon the then frontier of Nepal; on the south it included the wild "Jungleterry districts"; while between ran the valley of the Ganges, which, as the highway between Bengal and Northern India, had reached a comparatively

high state of civilization. Over this large tract of country Buchanan zigzagged with indefatigable zeal, noting the characteristics of the soil, its crops, and particularly its geology and mineral outcrops; the manners and customs of its inhabitants; and the sites and objects of archaeological interest. Needless to say, the record of his observations is of absorbing interest, both historically, as showing the state of the district in the early part of the nineteenth century, and also for purposes of comparison with present-day conditions. One valuable feature of the survey is the evidence afforded of the vast changes that have occurred in the configuration of the alluvial areas, owing to the constant shifting of the river channels.

Mr. Oldham's intimate knowledge of the province, apart from his other qualifications, makes him an ideal editor for such a publication. In addition to an introduction of thirty pages and a large number of useful notes to the text, he has provided eight appendices on points of special interest, a sketch-map showing Buchanan's itinerary, and a reproduction on an enlarged scale of the doctor's own map of the district. The Indian printer, by the way, has not shown as much care as the English editor; several misprints are noticeable in the text, while in one note "poem" has been turned into "peon," and in another "the log of the ship" has come out in the mystifying form of "the leg of the slip." This brings us to the question of the general appearance of the volume, which does little credit to the Patna Government Press. Type, binding, and lettering are alike poor and slovenly. Surely it is time that the official presses in India should endeavour to reach at least as high a standard as some of the non-official presses in that country. Even official reports lose nothing by being presented in attractive guise; while in the case of works intended for the general public it is obviously desirable that they should at least be turned out in such a fashion that purchasers need not be ashamed to see them on their shelves. W. F.

MALABAR AND THE DUTCH: being the history of the fall of the Nayar power in Malabar. By K. M. PANIKKAR. *Bombay: D. B. Taraporevala Sons & Co.* 1931. $9\frac{1}{2}\times6\frac{1}{2}$ *inches;* xxii+188 *pages; facsimile map.* *Rs.*6

The aim of the Dutch in the East was mercantile; their ambition was to obtain a monopoly of the trade in spices and to oust other nations, especially those with whom they were at war. Hence their hostilities with the Portuguese, whom they succeeded in depriving of their various strongholds, in the Malayan Archipelago, in Malakka, in Ceylon, and lastly on the coast of Malabar. The conquest of Cochin on the Malabar Coast was the last sanguinary encounter with the Portuguese previous to the ratification of the peace treaty of 1662. By these and other conquests the Dutch, whose real object remained purely mercantile, were compelled to assume political power. The Dutch East India Company, at the zenith of its power in the first half of the eighteenth century, saw in the subsequent years the greater part of its wealth disappear in the permanent struggle to retain its monopoly and supremacy over native rulers and European competitors; while the inner deterioration of its administration gradually lowered its vitality and brought about failure and fall in 1795, when Holland itself was in the throes of political misfortune and became involved in the consequences of the French Revolution.

In depicting the history of the 130 years of Dutch Settlement on the Malabar coast Mr. Panikkar gives us the view of the other side, of the forces which continually worked against the Dutch occupation and which prevented the Dutch East India Company from obtaining a monopoly of the pepper trade and led to their ultimate disappearance from that coast altogether. In that respect Mr. Panikkar's book is extremely interesting. European historians are often apt to

overlook the native point of view; but Mr. Panikkar has had the advantage of studying the records and chronicles in Cochin and the native States on the Malabar Coast as well as the records in the India Office and at the Hague. As Sir Evan Cotton in his foreword points out, "Malabar and the Dutch" is a history of the native states on the Malabar Coast during the time when the Dutch East India Company occupied their forts at Cochin and other places on that coast.

The character of the Dutch settlement is adequately summarized by the author's statement that "the Dutch on the Malabar Coast formed in many ways a tolerant and civilized influence, and their policy in trade, administration, as well as religion was based on sound and liberal ideas. Their one object was to carry on trade in such a way as to yield the largest amount of profits and ideas of glory, and desire for heavenly merit by converting the heathen and plundering the temples never entered into their calculations . . . the hundred years of their connection with Malabar constituted a period which was in many ways beneficial to the growth of civilization in Malabar."

Should Mr. Panikkar continue his researches in the local records it would be well worth his trouble to give us some further detail regarding the Jewish colony at Cranganore which once counted as many as 70,000 among its settlers, and then through discord and jealousy disappeared, leaving only records of its former greatness behind. W. R. B.

CORNWALLIS IN BENGAL: . . . together with accounts of the commercial expansion of the East India Company, 1786–1793, and of the foundation of Penang, 1786–1793. Publications of the University of Manchester. Historical Series, No. LX. By A. ASPINALL. *Manchester: University Press* 1931. 9×5½ *inches;* xvi+210 *pages.* 15*s*

This monograph, which forms one of the Historical Series of the Publications of the University of Manchester, is devoted chiefly to Lord Cornwallis's reforms in respect of criminal and civil justice and in other departments of the administration in Bengal. Appendices are added on the trade of the East India Company in his time, and the part he played in the retention of the first of our Straits Settlements, Penang, as it cannot be said that he founded that settlement, formal possession of which had been taken before he reached India. The third Mysore war, with Tipu Sultan (1790–92), in which Cornwallis played such an important part personally, is not dealt with, as not being connected with his Bengal administration. On the other hand, the most momentous act of Cornwallis in Bengal, namely the Permanent Settlement of the land revenue, in connection with which his name is chiefly remembered in India, has been altogether passed over, the reasons given being that the subject is too vast for a short monograph, that it has already been frequently and exhaustively dealt with, and that "History has long since recorded its unfavourable judgment." It is scarcely to be wondered at that a man who could commit an error with such enduring consequences as this would be liable to make mistakes in his other efforts at reform, actuated though he undoubtedly was by the best of motives. His exemplary personal character and moral courage earned for him the widest respect. In many directions he did introduce reform; his measures to stamp out corruption and abuses in all branches of the administration, his reorganization of the civil service with suitable fixed rates of salary, his recognition of the district as the real unit of administration, and his currency reforms are worthy of all praise. The errors he committed in other respects were principally due to his want of Indian experience, his tendency to enforce English principles, and his distrust of Indians as officials. Mr. Aspinall has dealt very fairly with his virtues and his faults, and has illustrated

his subject by very interesting details of the conditions prevailing in Bengal at the period, drawn from a mass of mostly unpublished records.

"It was the singular caprice of circumstances," Marshman observed, "that the man who had lost America was sent out to govern India, and the man who had saved India was subjected to a prosecution for high crimes and misdemeanours." The antithesis is not altogether fair to Cornwallis, but it well illustrates the unreliability of contemporary (not to say even later) public opinion. The greatness of Warren Hastings has not been recognized in this country till comparatively recent times, while the mistakes made by Lord Cornwallis were not generally realized till long after his death. C. E. A. W. O.

HUNTED THROUGH CENTRAL ASIA. By P. S. NAZÁROFF. Rendered into English from the Russian of the Author's Manuscript by MALCOLM BURR. *Edinburgh and London: Wm. Blackwood & Sons* 1932. 8 × 5½ *inches;* xii + 332 *pages; portrait and sketch-map.* 7*s* 6*d*

This is a readable account of the adventures of a Russian engineer, who after imprisonment in Tashkend during the Bolshevist seizure of that town, in August 1918, managed to escape during the brief "White" occupation and found his way to Chinese territory and so to Europe.

Mr. Nazároff writes well and interestingly of all he has seen, is shrewd and observant, and makes several original remarks. Though by profession a geologist, he includes much botany, archaeology, and geography in his notes. The descriptions of the luxuriant forests of Russian territory and the contrast they offer to the forests on the Chinese side of the frontier, are remarkable, and emphasize the differences between the two regions. The wonderful fertility of Pishpek is certainly not exaggerated, and is typical of much of Russian Turkistan which enabled that country to recover from the devastation of the Mongols. It is noteworthy that the author does not believe in the drying up of Central Asia, but rather that the rainfall is increasing.

The translation has been well done, though a more careful reading of the proofs would have avoided solecisms such as "mussulmen" (p. 150), "padscha" (p. 185), "Pumpelli" (p. 226), and "bek" everywhere for "beg." It is a pity that the book, in common with other offenders, contributes to the muddle of Central Asiatic place-names, *e.g.* Kuchara (p. 252) for Kucha, Tash Uy (p. 269) for Tash Oi, and Semirichie for Semirechia. The transliteration of Turki names is peculiarly bad, and a real blemish. There is a good index, but a disappointing map.

The book can be recommended as a useful contribution to the scanty literature on Russian Turkistan by one who knows his subject; but what would the British Consuls-General from Sir George Macartney to Captain George Sherriff say to Kashgar being described (on p. 310) as a remote hole? R. C. F. S

PUBLICATIONS OF THE PALESTINE SECTION OF THE MUSEUM of the University of Pennsylvania. Volume III. Beth-Shan Excavations, 1921–1923. The Arab and Byzantine Levels. By GERALD M. FITZGERALD. *Philadelphia: University Press* 1931. 12 × 9 *inches;* xii + 64 + xlii *pages; illustrations and plans*

This volume describes some of the results of excavation, during the years 1921–23, of the hill known as Tell el-Hosn, adjoining the modern village of Beisan, which preserves the ancient name Beth-shan, the fortress to whose walls the Philistines fastened the body of Saul. Beth-shan lies in Northern Palestine, at the eastern end of the valley of Jezreel, and, from a very distant past, the position has been recognized as one of military importance. It is about 16 miles south of the Sea of Galilee, and 3 or 4 miles west of Jordan. The fortress commands the

eastern opening of the route from the Mediterranean, through the valleys of Esdraelon and Jezreel, to the country east of Jordan, and dominates the junction of the latter valley with the Jordan rift.

Since the year 1921 the Palestine Expedition of the University Museum, Philadelphia, has been engaged in the excavation of the site, with results of great importance for Palestinian archaeology. The Tell is composed of a succession of strata formed of the remains of Crusaders' and Arab buildings on the top, down through Byzantine, Hellenistic, Israelite, and Philistine periods, to the times of Rameses II, Seti I, Amenophis III, and Thothmes III (1501–1447 B.C.). Few sites in Palestine have yielded such important discoveries, especially those of the three hundred years of the Egyptian occupation of Palestine; and it must be confessed that the lower, Egyptian, levels are of far greater interest than the upper. Still the latter have their importance, and deserve the admirable presentation which they receive in the volume before us.

The most interesting discovery in the upper levels is that of the foundations of a Round Byzantine Church on the summit of the Tell. The diameter of the outer circular wall is about 39 metres. It is thought that the inner circle of 25 metres must have been open to the sky. The church, with its adjuncts, is laid out on a somewhat elaborate geometrical scheme, which is explained. The measurement 7·1 metres, that is, 24 Roman feet, seems to have been freely used.

A paved Byzantine street on the top level of the mound, leading from the gateway at the north-west corner, was also uncovered; and there were many minor finds of lamps, pottery, stone and metal objects, and coins, which are all well described and illustrated. C. F. C.

AFRICA

LA ESPLORAZIONE DELLO UABI-UEBI SCEBELI, DALLE SUE sorgenti nella Etiopia Meridionale alla Somalia Italiana, [1928–29]. By LUIGI AMEDEO DI SAVOIA-AOSTA, DUCA DEGLI ABRUZZI. *Milano: A. Mondadori* 1931. 10×7 *inches;* xxviii+516 *pages; illustrations and maps.* L.150

Any one reading this account of the latest journey of exploration undertaken by that famous explorer and traveller, H.R.H. the Duke of the Abruzzi, will realize that, even if the epic period of African exploration—the days of Burton and Speke and Baker, of Livingstone and Stanley—is over, there is yet plenty of useful, difficult, and adventurous exploration to be done by those that like it.

This admirably prepared volume is an account of a journey undertaken by the Duke, accompanied by various specialists in different branches of science, with the object of discovering the sources of the river Webi which rises in the southern mountains of Abyssinia and to follow and map its course, hitherto mainly unknown, through the Abyssinian highlands of the Galla country, until it enters Italian Somaliland and finally loses itself in marshes before actually joining the other great river of Italian Somaliland, the Juba.

It is true that much of the Ethiopian Highlands had been already crossed and recrossed by various previous explorers, as is clearly shown in the sketch-maps of their routes which accompanies the maps of the Abruzzi expedition, but the special information regarding the sources, the nature, and the course of the Webi River, which the Duke was anxious to obtain, was still quite unknown. Therefore the journey can certainly be called one of exploration. The reason of the special interest manifested in this river is that it is one of the two main sources of water supply of Italian Somaliland, on which consequently the agricultural development and future prosperity of that Italian Colony largely depends.

In the short period between October 1928 and February 1929 His Royal Highness and the officers and scientists who accompanied him were able to explore and map nearly all the 1400 kilometres of the river's course in Southern Ethiopia from the source south of Mount Chillalo (3655 m.) to its entry into the plains of Somaliland. The expedition was able to collect extensive data of the hydrography of this river basin, as well as measures of the rainfall, which was of the utmost importance for the objects of the expedition.

In the preface H.R.H. says that the story of the journey itself is based on the reports compiled by Dr. Cerulli, with many particulars drawn from the diaries of himself and his companions, assisted by descriptions of the routes traversed by the topographical specialists, Captain F. Palazzolo and Lieutenant G. Braca, who were sent on subsidiary missions in order to fill in gaps with regard to the regions through which the main expedition passed and the course of the river.

The whole book is beautifully got up. The maps drawn by Captain Palazzolo and Lieutenant Braca are admirable for detail and clearness. The photographs, of which there are a great number, are first-rate and give an excellent idea of the country and its inhabitants. The scientific chapters which follow on the general narrative and deal with the inhabitants of the upper basin of the Webi River and with hygiene, with topographical and astronomical observations, geology, botany, and (less completely) zoology, seem to have been compiled with the greatest care and thoroughness which is characteristic of the expedition. While the actual narrative of the journey occupies only 129 pages of the book, the scientific chapters occupy 384 pages, *i.e.* from 129 to 513.

Two very interesting natural features were discovered for the first time in the course of the river Webi. Firstly, two fine waterfalls, over 300 feet in height, near Shedala, just above the confluence of the river Hako. These are described as truly magnificent, and certainly appear so from the photographs. Secondly, the gorges of the rivers Webi and Hako, which, after their junction, become a vast cañon not unlike those of the Colorado River. This cañon of the Webi is more than 1000 metres deep, and the two rims at Haroamara are 8 kilometres apart and precisely on the same level. The cañon continues, though decreasing in depth and increasing in width, for some hundreds of kilometres. Two extremely interesting places described in the narrative of the journey are the Pilgrimage Shrine of Sheikh Husein and the Fort and Tomb of the notorious Mad Mullah.

This book contains much of great interest for any one who cares for African travel, exploration, and research, and the reader feels when he has finished it that he has acquired far more than a superficial knowledge of the country described.

H. of P.

SOME EAST AFRICAN CONIFERAE AND LEGUMINOSAE. By L. CHALK, J. BURTT DAVY, and H. E. DESCH. (Forest Trees and Timbers of the British Empire. I.) *Oxford: Clarendon Press* 1932. 9½×6 *inches;* 68 *pages; illustrations.* 5*s*

This volume is the first of a series dealing with the forest trees and timbers of the British Empire, to be issued from the Imperial Forestry Institute at Oxford. The need for such a series has long been felt, and this first volume gives promise that the whole series will fill that need with conspicuous success. One of the great difficulties in dealing with timber samples sent home for identification has been the lack of herbarium material accompanying them and the consequent uncertainty of identification. The editors of this series have aimed at solving this difficulty and, with the help of forest officers and other workers in the Empire, are bringing together an authentic collection of timbers and herbarium specimens, the first results of the study of which are published in this volume. Thirteen

East African *Coniferae* and *Leguminosae* are fully described, and there are notes on other allied species. Under each species there is a full account of the anatomy of the wood, together with the synonymy, botanical description, distribution, economic uses, and other notes. The illustrations are one of the best features of the volume, each plate showing the habit of the tree together with photomicrographs of sections of the wood, while the line drawings illustrate the botanical characters of each species.

The series should be of use not only to professional botanists and foresters but also to general naturalists and travellers in the Empire who wish to identify the trees which they meet with in their travels. J. S. L. G.

THE GEOLOGY OF SOUTH-WESTERN UGANDA, with special reference to the stanniferous deposits. By H. A. Stheeman. *The Hague: Martinus Nijhoff* 1932. 11½×8 *inches;* xvi+144 *pages; illustrations and maps.* 10 *gld*

Dr. Stheeman's book is based on work carried out by him since 1929, on behalf of the Billiton Company. Of the five parts into which the work is divided, Part I contains the matter of the greatest interest to the geographer, whilst the remaining four parts are of such a technical nature as to be of interest only to geologists. In the introduction the author gives a brief account of the types of vegetation and climate to be found in Central Africa. The remaining four chapters of Part I are devoted to a detailed and clear description of the way in which the Uganda Arenas have been formed: an arena consists of a gently undulating plain surrounded on three sides by a steep escarpment; usually the floor is formed of granite, the walls of sedimentary rocks. He shows that the transport of material from the encircling walls across the dry arena floor is effected by "Flood Sheet" and by "Creep," both of which processes are described in detail. The author is to be complimented on a sound explanation of a long-standing problem. The remainder of the book is more purely geological, and includes detailed descriptions of the Karagwe–Ankolian System and its relation to the Granites; special attention is paid to the Tectonics, Metamorphism, and finally to the tin deposits themselves.

The book as a whole is undeniably a valuable contribution to the geology of Central Africa, and in particular to Stanniferous deposits. It has six maps and is well illustrated with photographs and diagrams. The production is good and well upholds the previous standard of the publishers. V. E. F.

FORTY YEARS IN AFRICA. By Major Tudor G. Trevor. *London: Hurst and Blackett* 1932. 9×5½ *inches;* 278 *pages; illustrations.* 12*s* 6*d*

Brave, loyal, and upright in character, by nature a lover of those who have these qualities and an observer of men of all sorts, by inclination a soldier and by profession a mining engineer, the author of this book spent the greater part of his active life giving free scope to his nature, following his inclination when circumstances allowed and practising intermittently his profession in Africa south of the Equator. He was at home in every society except that of financial magnates for whom he does not attempt to disguise his intense dislike. He speaks of the fine qualities of Swazis and Zulus, and gives an insight into some of their customs —those connected with witchcraft and matrimony. He has sympathy for the result of miscegenation, and pity for the poor white. He was on good terms with the old-time Boers, and tells with feeling the tragedy of De La Rey's death. He was in the Boer War and in the Great War, both in German South-West and German East Africa. His sketches of the generals under whom he served are incisive and not invariably flattering. Possibly it is of the less conspicuous characters that he came across that his best stories are told. Those of the Austrian

aristocrat, known in South Africa as the "Wandering Jew," of the grossly fat drunken German who turned out to be the Prince of Salm-Salm, of the parson hunted by lions, of brave Boer women, and of some gay ladies are told with pathos and humour. His chapter on War, Women and Wine is not one likely to provoke the anger of the South African Women's Federation, as did the book recently published under that title. He has respect for the man who does a man's job—at the front, in the mine or on the farm; but has little use for the soldier at the base or the maker of money anywhere. Sammy Marks is forgiven for his sense of fun. His book gives a good picture, though a slightly flickering one, of the life in Africa of one who preferred the veldt to the town, who was always ready to take on work provided it was man's work, and who looks back with enjoyment on every minute of it. It is worth reading. **M. N.**

EXPOSITION COLONIALE INTERNATIONALE DE 1931. 10 volumes. *Paris: Société d'Editions Géographiques . . .* 1931. 11 × 9 *inches.* Le Gouvernement Général de l'Afrique Occidentale Française. 256 *pages.* La Côte d'Ivoire. 134 *pages.* Le Dahomey. 152 *pages.* La circonscription de Dakar et dépendances. 174 *pages.* La Guinée. 146 *pages.* La Haute-Volta. 170 *pages.* La Mauritanie. 62 *pages.* Le Niger. 88 *pages.* Le Sénégal. 274 *pages.* Le Soudan. 166 *pages. Maps*

AFRIQUE OCCIDENTALE FRANCAISE. By ROBERT DELAVIGNETTE. *Same publisher, date, and size;* 232 *pages; illustrations and maps*

The first ten volumes are official publications; the last is one of a series of eight volumes descriptive of the French Colonial Empire. All are published in connection with last year's International Colonial Exhibition.

The volumes issued by the Government of French West Africa are written on the same plan, the first being a summary of the remaining nine which deal more particularly with each of the Lieutenant Governorships. The information covers the ground that should be found in official handbooks and is well summarized and presented. The maps however are but rough sketches. Of special interest is the hydrography of the Niger and its reservoirs, lakes Debo, Faguibine, and Nianga, between Sansandig and Timbuctu. In this vast region, now subject to annual inundation but once the centre of the ancient kingdom of Ghana, accurate surveys have demonstrated that the Niger, instead of lying at the bottom of a basin, actually flows at a higher level than the plains on its left bank. Moreover two ancient arms of the river have been traced for 60 and 200 kilometres respectively. With this natural configuration, reclamation and irrigation should be comparatively easy, and it is estimated that eventually there might be a minimum of 850,000 hectares of rice and cotton fields. But where the cultivators are to come from is another matter.

Of greater general interest is the volume by Robert Delavignette, well written and illustrated with woodcuts. In a series of vivid pen pictures the author describes from long personal experience scenes and life in French Africa, laying special stress on the reactions of the African to Western civilization. We may not agree with all his views, but at least he has thought and gives us food for thought. The raw material, human, economic and climatic, is the same in French and British West Africa; it is only methods that differ, and conspicuous among them is the French system of conscription with all the political, sociological, and economic problems it implies. **F. H. R.**

GORDON AND THE SUDAN. By BERNARD M. ALLEN. *London: Macmillan & Co.* 1931. 9 × 6 *inches;* xii + 486 *pages; illustrations and maps.* 21*s*

Thirty-odd books have been written about Gordon, but this may well be the last,

for he would be a bold man who tried to add anything to Dr. Allen's study, to which one can only apply the hackneyed epithet exhaustive. The author has drawn upon every possible source for his story, from personal interview of Gordon's servant at Khartoum to the deciphering of Arabic telegrams in the Record Office. Aided by much new material published in the last thirty years and by a very effective combination of quotation and narrative he gives us a picture of intense interest. Of recent years, largely owing to Strachey's portrait of him in his 'Eminent Victorians,' we had grown familiar with the picture of Gordon as something approaching a religious fanatic ruling the Sudan with a Bible in one hand and a bottle of brandy in the other. Dr. Allen exposes in detail the sources for this view and shows it to be as unfounded as the accusations of brutality and dishonesty brought against Gordon by Long, his American subordinate, writing forty years after the event.

We are given a detailed account of the circumstances which led up to Gordon's second mission to the Sudan, and of the misunderstandings, particularly in Gladstone's mind, which contributed so much to the delay in sending the expedition for the relief—how Gordon hated the phrase—of Khartoum. An appendix throws new light on the fatal delay in January 1885 whereby the steamers reached Khartoum two days too late. It is the little things which count: would Gordon have been saved if one of the senior officers at Metemma had not been afflicted with a painful boil?

Of especial interest to geographers is the story of the exploration of the last stretch of the Nile between Lake Albert and the River Asua, which had not been seen by Speke or Baker, who had avoided it by going inland from the river. One of Gordon's main objectives was to get his steamers through to Lake Albert, and Dr. Allen gives us a vivid picture of his hopes and disappointments, of his ceaseless struggle with unexpected rapids and hostile tribes, and with the ill-health which decimated his strangely international staff of British, Americans, Frenchmen, Germans, Italians, and Egyptians. The discovery of the Fola Rapids, the seventh cataract of the Nile, put an end to his hopes of reaching the lake by steamer. It was typical of the man that when the solving of the Nile's last secret lay at his feet he refused such "wretched pinchbeck honours," and left to Gessi the credit of being the first to trace the river to Lake Albert.

There are reproduced some interesting sketches and original maps from the Society's collection. A continuous map of the Nile from Lado to the lakes would have been helpful in following the events in Part I. W. B. K. S.

NORTH AMERICA

THE CANADIAN CLIMATE. By CLARENCE EUGENE KOEPPE. *Bloomington, Illinois: McKnight and McKnight* 1931. 9 × 5½ *inches; 280 pages; illustrations and maps.* $2.50

In this work the author brings together for the first time a great deal of scattered information, published and unpublished, on the climate of Canada and Newfoundland, and he acknowledges in particular his indebtedness to the Canadian Meteorological Office at Toronto, without whose active assistance the study would not have been possible. The first four chapters discuss the climatic factors and elements of the Dominion as a whole, the last four the regional divisions, and there follow bibliography, tables, and index. Canada has great diversity of climate, but the wide inlets of the sea commonly ice-encumbered, the vast number of lakes, and the generally high relief leaving only a relatively small area at sea-level, make for complex local peculiarities. In Canada the thermal contrast between the seasons is very great. Whereas the entire country, excepting the

mild rainy Vancouver coast, is very familiar with winter temperatures far below 0° F., a surprisingly large area, on the other hand, is subject to summer temperatures over 90° F. and even 100° F., the absolute extremes officially recorded being —79° F. at Fort Good Hope, in the Mackenzie Valley, N.W.T., and +110° F. at Channington Manor, Saskatchewan, and at Griffin Lake, British Columbia. Precipitation varies from over 100 inches a year in the high mountains of British Columbia, and over 40 in Nova Scotia and Newfoundland to below 20 in the prairies, and below 10 in the Arctic, as well as in certain rain-shadow valleys of British Columbia. Snowfall is enormous in the Selkirks and Rockies, rather light in the western prairies but very heavy in all the eastern provinces of Canada, where the winter cyclonic storm-routes converge. During the winter of 1904–05 an interminable succession of furious blizzards brought life in Nova Scotia nearly to a standstill. The untravelled reader of this excellent book will learn to avoid forming stereotyped conceptions of the Canadian climate on the basis of prominent characteristics. Thus he will find that over much of Canada the normal freezing winter weather is liable to be broken by mild spells with the thermometer at 50° F., just as the open English winter is now and then interrupted by spells of frost.

The Peace River country enjoys a dry invigorating climate favourable to agriculture, without violent storms, the summers being warm and sunny, the winters steadily cold with occasional interludes of balmy Chinook wind. In the chapter on Arctic Canada we find a vivid description quoted from Ekblaw on the seasonal course of daylight and darkness at Etah, in North-West Greenland, latitude 77°.

The illustrations are clear and entertaining, but some of the sketch-maps are difficult to read without straining the eyes. L. C. W. B.

CENTRAL AND SOUTH AMERICA

IN THE WEST INDIES. By JOHN C. VAN DYKE. *New York—London: Charles Scribner's Sons* 1932. 7×5 *inches;* x+212 *pages; illustration and sketch-map.* 8*s* 6*d*

The gorgeous colours of one of Earth's most beautiful seas are here lovingly depicted by an artist, the vivid lights and shadows of tropical skies and waters, of crags and crops, of mountain and forest so convincingly painted that they can be seen by the eye of memory even here in grey London. Nature's children, trees, plants, birds, and beasts, are described with intimate knowledge of their life, distribution, and habits in this entrancing book. To one who has loved all these things, but only instinctively, for twenty odd years, it is a matter for great regret that such enlightenment was not available before, to enhance appreciation.

When Professor Van Dyke turns from nature to the works of man the praise changes to somewhat uncompromising scorn, rather marked when the object decried is British. It may be a good thing to see ourselves as others see us; and the artist must be allowed to find a contrast. But repeated criticism of shabbiness to those who are too poor to remedy it is scarcely kind or helpful. The author states that he is unable to ignore the existence of distress and sorry conditions. Do not similar conditions exist throughout the whole world? Though more obvious, they are actually incomparably less in the West Indies than in what are generally termed civilized countries. There is certainly allusion to underlying causes, such as the racial characteristics of the distressed classes and the vested interests existing. But the general impression conveyed is that the distress is due to the negligence of the Governments responsible.

The comparison of Puerto Rico with Java makes no mention of the fact that

the latter island is populated by one of the most industrious races in the world, a race native to the soil. Neither description can be applied to the labouring population of any West Indian island. And why should Jamaica be described as a field of discord, poverty, misery, disease, and injustice? Basseterre, St. Kitts, is singled out for special condemnation. "The shanties where the negroes huddle together . . . the same old conditions . . . the same old misery." Professor Van Dyke apparently did not go ashore in 1931, his last visit, nor make any inquiries. Had he done either he could not have failed to discover that, despite the adverse finances of the past few years, great strides had been made in that town for reduction of slums and improvement of housing conditions. He might even have seen from the ship's deck the exceedingly good model village, overlooking town and roadstead, which was being built for the lower classes. Surely biting criticism should not be made without certainty as to fact.

The author, while laying stress on the prosperity brought to Haiti and the Filipinos from the wealth and energy poured in by the American Government, is very sceptical as to the existence of real contentment or the permanence of good rule. Administration of the American Virgin Islands is stated to cost the U.S. Treasury over $10 a year per head of the population governed. With such generosity it is easy to believe that the town of St. Thomas looks bright and smart. In spite of this apparent prosperity Professor Van Dyke owns that the British policy of giving liberty and protection to the native and leaving him to work out his own economic salvation is perhaps the best. And yet, a few pages later, he recommends that England and France should barter their West Indian peoples to the United States in exchange for war debts! As neither the Englishman nor the Frenchman sells his children the suggestion may be ignored, as may the unworthy jibe at the "brave" estate owners and their political pull. But the statement that the blacks would not care a rap about the manner of white man placed over them must be emphatically contradicted. The black man in the British West Indies knows exactly the treatment accorded to his fellow blacks in the United States, and is intensely loyal to the British flag.

Professor Van Dyke condemns Caribbean and other tourists for causing misunderstanding among nations by "judging of everybody and everything from insufficient premises." Has he not laid himself open to the same charge?

Despite the faults criticized, the book should be bought and read by all visitors to the West Indies, and by the residents there, for its artistic value; and the candid though superficial criticisms should be studied, but weighed, by the thoughtful.

J. A. B.

OUTLINE OF THE GEOLOGY AND PETROLOGY OF SURINAM (Dutch Guiana). By R. IJZERMAN. *The Hague: Martinus Nijhoff* 1931. 11 × 8 *inches;* xvi + 520 + 48 *pages; illustrations and maps.* 24 *gld*

Dutch Guiana, Surinam, is a small, nearly rectangular country in the north-east of South America, measuring 400 kilometres in a north-south direction and 350 kilometres from east to west. In a handsome volume, profusely illustrated, Dr. Ijzerman puts before us a painstaking treatise on the Geology and Geography of this area. The first ninety-five pages contain the matter of greater geographical interest, the residue being largely petrography.

The northern coastal strip of Surinam is a mangrove-fringed swamp which passes imperceptibly into a zone of low plains where tangled forest belts enclose savannahs, or plains covered with rank, poor grasses. Farther inland a gradual transition takes place from the flat to foothills and mountains, the highest peak attaining 4180 feet above sea-level in the Wilhelmina Mountains. Six rivers rising within the colony flow approximately from south to north. The mountains

and hills rise from broad flat valleys and exhibit the features of an old, nearly mature topography. Under a thick mantle of vegetation the valleys and ridges are thickly covered by a deposit of soil or laterite. Exceptionally isolated steep cupolas of rock rise in several localities which do not conform to the more usual gentler contours of the general peneplanation. These are regarded as residual forms. Near the centre of the colony a tableland bordered by cliffs on all sides, and 70 square kilometres in area, stands at a height of 3500 feet above sea-level. This unique feature is formed from the Roraima red-sandstone series, whereas the rest of Surinam is formed of igneous or metamorphic rocks.

The page and a quarter devoted to hints to travellers is very valuable, and the remarks apply equally to travel in any of the forest belts in the north of South America. The statement that "four kilometres is a good day's journey" away from the rivers and where a trail has to be cut, is no exaggeration. The reviewer recalls districts in which only half that distance may be accomplished in one day. The remark that "jaguars are sometimes very audacious" whets our appetites for anecdotes, which unfortunately are not forthcoming. The author is unorthodox when he doubts "whether the waterfalls are ever affected by retrogressive erosion, and gradually move upstream." His explanation of the formation of the savannahs by the leaching from the soil of all plant nutrition in raised, permeable areas is more satisfying, and he emphasizes that there is no dearth of rainfall where the savannahs are found.

The only minerals of economic importance are gold and bauxite, but kaolin, psilomelane, cassiterite, cinnabar, or thite, and monazite occur in small quantities. The problem of the age of the Roraima formation is stated, but the answer is not yet certain, although some consider it to be Cretaceous. Dr. Ijzerman reviews the literature on the geology of the neighbouring countries of the Guiana Highlands, viz. British and French Guiana, southern Venezuela, and part of north Brazil, and more briefly that on other parts of the Brazilian Shield and the igneous rocks of the northern Andes. The book is well indexed and there is a valuable bibliography which is augmented by many references, in footnotes, to a wider literature.

It is a matter for regret that the indefatigable author should have neglected to get an English friend to read through his proofs, as a few slips in the use of prepositions have occurred, and here and there the idiom is unusual. The use of "find spot" for locality, "dissoluble" for soluble, "peneplainisation" for peneplanation, "ore" for magnetite is an outcome of this, as are the misprints such as easely (p. 3), ony for only (p. 342), systeme (p. 487), and dubble (plate 36). On p. 492 Angustora should probably be Angostura. But these minor blemishes do not diminish our admiration of the author's industry, or our gratitude to him for having published his admirable monograph in English. J. V. H.

THE COUNTRY OF THE ORINOCO. By LADY DOROTHY MILLS. *London: Hutchinson & Co.* 1931. 9 × 5½ *inches; 288 pages; illustrations and sketch-map.* 15*s*

Though she did not succeed in seeing all that she had intended, Lady Dorothy Mills has nevertheless written an interesting account of the Alto Orinoco and the hinterland of Venezuela. She has much, almost too much, to say of the discomforts of the journey, and from her descriptions of the region she visited it seems hardly destined ever to be a popular resort. "The Orinoco is the greyest river I have ever seen . . . it never looks clear or dark, like other rivers." The limit of her travels was Ayachucho, the tiny capital of Amazonas, on the borders of Colombia. Much of the book is taken up with details of the customs of the Indian tribes, who live in the forests or country round here; and, though there is

little that is actually new, it is useful to have recent corroboration of the known facts. Its earlier chapters deal with more familiar places, such as Caracas, Maracaibo, and Ciudad Bolivar, and the descriptions of these are picturesque and interesting. The book is well illustrated, and its racy style makes it easy to read. A. W. S.

AUSTRALASIA AND PACIFIC

EASTER ISLAND: Home of the Scornful Gods. By ROBERT J. CASEY. *London: Elkin Mathews and Marrot* 1932. 9½×6 *inches; 338 pages; illustrations and sketch-map.* 18*s*

There are two standard works on Easter Island: Mrs. Scoresby Routledge's 'Mystery of Easter Island' and Dr. Macmillan Brown's 'The Riddle of the Pacific.' The student will not find in Mr. Robert J. Casey's book much information that has not been set down already by these learned authors; but Mr. Casey does not profess to be a scientist (he went to Easter for the purpose of making motion-pictures), and since the works referred to were not designed primarily for the lay reader it would be churlish not to welcome a book which deals more popularly with the island whose gigantic statues, bird cult, and mysterious script have puzzled the world since the Dutch Admiral Roggeveen discovered the island (while looking for the lost Davis Land) on Easter Day 1722. At the same time, if Mr. Casey thinks fit (as he does here) to borrow extensively from other writers who have laboured assiduously on the same ground before him he should learn that it is but courteous to give them full credit, by exact quotation and reference, for what he takes. This he does not do, and it is necessary to place this fact on record in fairness to Mrs. Routledge and Dr. Brown. Mr. Casey is at times careless, too; as, for example, when he refers, on p. 17, to the land sighted by Davis as having been 500 miles west of the South American coast, instead of 500 leagues, a very different matter.

However Mr. Casey deserves every credit for his enterprise in making the trip from Tahiti to Easter and back (a distance of something like 6000 miles) in a 34-ton schooner, with a Polynesian navigator who succeeded in making the island without a chronometer and almost by instinct. The outward passage was a hazardous one, for, after leaving the Gambier Archipelago and Pitcairn (to both of which Mr. Casey devotes some interesting chapters) the schooner ran into a hurricane which all but caused her destruction, but failed to quench either Mr. Casey's enthusiasm or his sense of humour. He is perhaps a little too afraid of being dull, but once adjustment is made to his somewhat flamboyant manner of writing, his description of the island and its puzzles will be found agreeable reading, and his book is illustrated by some good photographs, excellently produced. O. R.

POLAR REGIONS

DER WEG NACH DEM POL. By R. SAMOILOVITCH. (Monographien zur Erdkunde. Bd. 46.) *Bielefeld and Leipzig: Velhagen and Klasing* 1931. 10×7 *inches; 38 pages; illustrations and maps*

Professor Samoilovitch, in thirty-three pages, gives a concise account of Arctic exploration down to the year 1930. The various incentives to exploration, the technique, achievements, and scientific results of each expedition are clearly indicated. The only omission of importance appears to be the Canadian Arctic Expedition under Vilhaljmur Stefansson. This short essay is useful for the account of the development of flying. The author, it will be recalled, was in

command of the Russian ice-breaker, *Krassin*, which played a leading part in the rescue of the survivors of the airship *Italia*. After examining the relative merits of the aeroplane and airship, he argues in support of the ice-breaker as the best instrument for future exploration. Modern scientific research requires observations over long periods, which can be obtained at circumpolar stations, or, even better, from vessels capable of combating polar ice and drift. An ice-breaker, further, could be used as a base for air flights. Professor Samoilovitch, naturally, waxes enthusiastic on this theme, and concludes with the hope that, in the international polar year, an opportunity will be afforded of fully testing the *Krassin*.

G. R. C.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

INTRODUCTION TO THEORETICAL SEISMOLOGY. By J. B. MACELWANE and F. W. SOHON. Part II. Seismometry. By F. W. SOHON. *New York: John Wiley & Sons—London: Chapman & Hall* 1932. 9×6 *inches;* x+150 *pages; illustrations.* 16*s* 6*d*

This book is a useful account of the instrumental side of seismology, and probably the first in English since that of the late G. W. Walker. It begins with the simplest problem, that of simple harmonic motion, and proceeds by easy stages through linear damping to the theory of actual seismographs and their registration. The principles of direct photographic registration as in the Milne-Shaw and Wood-Anderson machines, the smoked paper method as in Wiechert's, and the galvanometric method as in the Galitzin and its modifications, are all developed. The problem of obtaining a suitable instrument with a reasonably long period to determine the vertical component of the motion of the Earth's surface is discussed sufficiently to bring out the difficulties and the nature of attempts to overcome them; though here one misses a reference to the work of L. F. Richardson. Methods of determining the constants of the instruments are carefully treated. Some modern instruments are mentioned without full discussion, but their principles are described and references are given to complete accounts. The last chapter is devoted to methods of determining epicentres.

H. J.

ECONOMIC AND HISTORICAL GEOGRAPHY

THE FRENCH COLONIAL VENTURE. By CONSTANT SOUTHWORTH. *London: P. S. King & Son* 1931. 8½×5½ *inches;* xii+204 *pages; illustrations.* 12*s* 6*d*

The heading of the first chapter of this book is "Why Colonies?" but this is expanded in the chapter itself to mean "Do Colonies bring financial advantages to the countries owning them?" It is only from that aspect that the French Colonial Venture is studied in this work. The study, which might be said to be French in its lucidity, has been prepared because it seemed to the author that the world needed a "systematic appraisal of the economic profit and loss to colonising nations of specific jobs of colonisation." After a concise description of the second French Colonial Empire, of how its parts were acquired and are classified, of their distribution and resources, the author investigates "the amount, if any, by which expenditures of the French Government on the colonies have exceeded any substitute expenditures which the absence of colonies might have imposed on France," and comes to the conclusion that "the full amount of the expenditure of the French Government on the colonies over and above its receipts from colonial governments" should be treated as the cost of colony ownership to France. Against this cost he sets 2½ per cent. of the total value of

French colonial trade—imports and exports combined—which he considers, for reasons he gives, may be regarded as a gain to France attributable to the ownership of colonies. He augments this sum by the amount he estimated was gained at the time of the depreciation of the franc by export to colonies rather than to foreign countries. He next considers the gains to France from capital investment in the colonies, but deduces from his investigation that the economic asset to France in this connection has been only the sum due to depreciation in the real value of French colonial bonds in the years of the unstabilized franc. His conclusion from these calculations is that "the French colonies from an economic point of view had been an unprofitable venture for France, and that they will probably remain so for many years to come." On the whole he thinks that the interests of France would be best served if she left colonial development to other powers, but as a politico-economic compromise he suggests that she should, for political, military, psychological, as well as for certain economic reasons, retain North Africa—Algeria, Tunisia, and Morocco—and, on account of their being a direct aid to a French domestic industry, the small islands of St. Pierre and Miquelon off the coast of Newfoundland, but should free herself from all her other colonies which are mainly tropical. At the end of the book he recommends other nations to make the valuation of national ventures in money terms as a first step in bringing rationality into their actions and policies.

To the above analysis of Dr. Southworth's book, largely in his own terms, must be added a short description of his methods. He has collected with painstaking care the statistics of French colonial expenditure, civil and military; the figures of imports and exports into and from the French colonies from and into France, and from and into foreign countries; and the results of capital investments in the securities of French and of other colonies and of France itself from 1871 onwards, as well as more detailed figures for the more recent years. He has corrected these figures to make them constitute fair data on which to build his arguments. Wherever it is necessary to make estimates which are not directly based on these data or to draw conclusions from them which may not secure general acceptance, he claims that his estimates and conclusions are always made with the idea of giving the benefit of the doubt to those who believe that France has gained and will gain by her colonies against those who have a leaning towards the conclusions to which the author ultimately comes. As to how far he has succeeded in doing this some of his readers will have doubts. One is left with the impression that sometimes a very large assumption is made and that the modification of it resulting from the benefit of the doubt is scarcely adequate. The book requires and deserves careful study; it is systematically arranged; its tables are clear; its appendices are useful. The illustrations, which all refer to Africa, mostly to West Africa, are, possibly with intention, uninviting and are scarcely relevant to the text. More so to that of the second chapter would be a map of the African colonies; this would call attention to an obvious slip on p. 15 in a statement as to the position of Togo. M. N.

THE PIONEER FRINGE. By ISAIAH BOWMAN. (American Geographical Society. Special Publication No. 13. Edited by G. M. WRIGLEY.) *New York:* 1931. 10 × 6½ *inches;* x + 362 *pages; illustrations and maps.* $4.00

Modern scientific geography has been described as human ecology in that it attempts to build up a living and concrete picture of the human environment and of the relationship between the human species and that environment. If the formulation of such a conception is the work of the modern geographer, it follows that his work must play an important part in the future; for just as the experience gained by a Canadian farmer in adapting certain types of wheat to his climatic

conditions can be utilized by the pioneer on the Russian steppes where soil and climatic conditions are similar, so the experience gained by settlers in one part of the world can, if scientifically studied, be utilized by settlers in other regions where geographical conditions are found to be similar. In this very important book Dr. Bowman has set out to present a composite picture of conditions found in what he has so well called the pioneer fringe—the fringe of settlement between the arid lands of the Earth's surface, where settlement may for ever be impossible, and those more fortunate and well-watered lands where settlement is assured. The book is divided into two parts, the first entitled "Generalities," the second "Regional Examples." In the first part he analyses the factors, geographical, economic, and other, which affect or have affected the life of the pioneer. He writes well, in a clear, pithy, yet delicate style which will appeal to a very wide circle of readers. His apt quotations and quiet jests, as well as the abundance of beautiful photographic illustrations, combine to render his whole work delightful, quite apart from its very great scientific importance. One is left with the opinion, after reading Part I, that man is an unreasonable animal. The spirit of adventure or an unreasoning optimism may lead him to seek the hard life of the pioneer and to attempt to develop land, where geographical, especially climatic, conditions are in reality unsuited to permanent settlement, when there still remain areas for closer settlement in regions where the future is more definitely assured. It may be that we do not need more land, yet men keep moving towards the frontiers to bring fresh areas under the plough. Even when other economic factors, such as differences in taxation, have been considered, there remains what would seem to be a hunger just for land alone, the desire not only to possess but to subdue vast areas of new territory, almost independently of the question—does it pay?

In the second half of the book, which deals with regional examples, those studied in detail include the western zones of experiment in the United States, the Canadian fringe of settlement, Australia, South Africa, Siberia, Mongolia and Manchuria, and the South American hinterlands. It will be seen that these pioneer fringes are, for the most part, those areas where the already settled temperate grasslands pass into more arid tracts. In South Africa the problem is concerned with a more definitely tropical area of settlement, and in Canada and Siberia we observe the northward movement of the pioneer. Perhaps what strikes one most about these regional analyses is the way in which each area has been a law unto itself; up to the present there has not been the exchange of information gained by experience between the areas of pioneering settlement which is so desirable for the future. There is still a widespread conception that it is only necessary to persevere and to apply modern scientific methods to make farming in these pioneer fringes of the world pay; and that we may therefore expect the gradual conquest of the world's desert fringes. But experience in the great plains of the United States would seem to prove that this is not the case. The tide of advancing settlement has been driven back in these areas by adverse geographical conditions. Indeed, Australia will not yet believe the truth, and it is to be hoped that this book, by an independent observer of the widest possible experience in other parts of the world, will be read and studied by those who have a share in the administration of the affairs of the Commonwealth. Something of the empirical control exercised by some of the geographical factors must be apparent to every reader who has even skimmed through this volume. As the author says, "the Canadian farmer of the north country may not know what an isotherm is, but he has a genius for following it." But Canadian isotherms reappear in Siberia and in Manchuria, and the control which they have been shown to exercise in North America will be exercised also in Asia, and so will supply the check to the movement which is described in the chapter entitled

A Modern Invasion, and which refers to the present movement of population into Mongolia and Manchuria.

It is impossible to do more than indicate the scope of this important book. It is not too much to say however that it is probably one of the most important contributions made by scientific geography to the elucidation of world problems that have appeared within the last decade, and it is to be hoped that it will bring the aims and methods of the modern geographer before a very wide circle of readers. L. D. S.

GENERAL

DIE WELTKUNDLICHE JUGENDBILDUNG IN HEIMAT- UND Erdkunde. By PETER ZEPP. (Handbuch der Erziehungswissenschaft. Edited by F. X. EGGERSDORFER and others. IV. Teil. Besondere Bildungslehre. Band 3.) *München: Josef Kösel and Friedrich Pustet* 1931. $9\frac{1}{2}\times6\frac{1}{2}$ *inches;* x+368 *pages; illustrations and maps. M.*14.50

NEUES LEHRBUCH DER GEOGRAPHIE. By MAX ECKERT. *Berlin: Georg Stilke* 1931. 9×6 *inches;* xvi+596 *pages. M.*20

The first work is a volume in a series treating of educational science. Its main interest will probably lie in the detail it supplies on the scope and organization of geography in present-day Germany. Every branch of modern geography is considered in relation to school work and methods of instruction. Special emphasis being laid on the study of the home region, it is perhaps not surprising to find later that the ignorance of Germans of conditions outside their own country is lamented, though the difficulty of implanting a "national" rather than a "nationalistic" outlook is recognized. The importance of the physical map is also stressed. The bibliography is confined to books in German. The technical vocabulary may present some difficulty to English readers.

Dr. Eckert believes that there is still room for a general survey of geography, as text-books have tended lately to become reference works or miniature encyclopaedias. His six hundred pages of Gothic type, unrelieved by diagram or sketch-map, have rather a forbidding aspect; but they appear to cover the ground systematically. His difficulty has been to give sufficient detail for the student without exceeding his space or discouraging the general reader. He might have partly overcome this by excluding much of the historical detail. It should be added that sketch-maps have been omitted purposely—the introduction giving references to suitable atlases. This book is apparently the first volume of the work only. G. R. C.

FAR PLACES. By JAMES MACKINTOSH BELL. *Toronto: The Macmillan Company of Canada (London: Macmillan & Co.)* 1931. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* xvi+174 *pages; sketch-maps*

In this volume Dr. Mackintosh Bell, the well-known Canadian mining engineer, gives an account of his journeys in such far and diverse places as Great Bear Lake, New Caledonia, the Kirghiz Steppes, Albania, Jamaica, and the Great Slave Lake. No illustrations accompany the text: nor are they necessary, for the author has the happy facility of conveying to his readers' imagination a vivid picture of his observations and adventures.

Dr. Bell is an old-timer in the North-West, and the accounts of his trips down the MacKenzie River to Great Slave Lake, Great Bear Lake, and the Barren Lands beyond are valuable in revealing the technique of an experienced traveller and in giving a faithful and sympathetic portrayal of the fur traders and Indians of the northern forests. The author has traversed these regions both by air and

by canoe, but he dwells chiefly on his earlier journeys prior to the opening up of Northern Canada by aircraft, when the Hudson Bay Company's posts and an occasional mission station were the sole emblems of civilization.

It is a far cry from Fort Norman to New Caledonia, the French settlement in the Southern Pacific, of which Dr. Bell gives a fascinating account. His pages reflect the warmth and colour of the tropics as truly as they carry the tang of northern blizzards, and with the same flexible quality he etches the light and shade of all sorts and conditions of men with whom circumstances oblige him to rub shoulders.

It is perhaps an error of judgment that the book should conclude with chapters dealing with brief visits to Jamaica and Albania, where the author strays little off the beaten track. The tourist and the pioneer are not satisfactory bedfellows, and the reader will regret that Dr. Bell has not enlarged—as well he might—upon his varied experiences of pioneer life as an alternative to ending his itinerary on broad macadam roads where charabancs whizz by.

A small-scale map of the area traversed faces each chapter of this interesting book. There is no index. G. B.

BARROS ARANA: educador, historiador y hombre público. By RICARDO DONOSO. *Santiago: Universidad de Chile* 1931. 10×7 *inches;* 338 *pages*

This centenary biography is an *apologia* for the work of Diego Barros Arana (1830–1907) in promoting secularist ideals and modern studies in the High School and University, and in defence of Chilian interests during the boundary dispute with Argentina. R. A.

ADVENTURES OF AN ALPINE GUIDE. By CHRISTIAN KLUCKER. Translated from the third German Edition by ERWIN and PLEASAUNCE VON GAISBERG. Edited and with additional chapters by H. E. G. TYNDALE. *London: John Murray* 1932. 9×5½ *inches;* xiv+330 *pages; illustrations and sketch-map.* 10*s* 6*d*

I well remember, some time in the eighteen-eighties, how there came to Zermatt, I think in the company of Mr. Norman Neruda, an Alpine guide of a type new to most of us. This was Christian Klucker, an Engadine man from Sils, who was preceded by a considerable reputation. He was a joyous kind of person, sturdy, and rather stocky in build, and of excellent temper. He was ambitious of new ascents, and capable not merely of making but of devising them. He signalized his coming by climbing the Lyskamm up its north face. This is the man whose reminiscences, which have already passed through three German editions, are now presented to us in an English translation. He began life as a wheelwright, but he was always a reader and prided himself in later years for his Alpine library. The mountains exercised a powerful attraction on him from boyhood, and he took every opportunity of learning the Alpine craft. He had the nature of an explorer. When he began climbing, though the principal Engadine mountains had been ascended, little was known about the topography of the region to the south-west. The exploration of the surroundings of the Disgrazia and Badile areas were largely his work and resulted from his initiative. Though the peaks within that region are relatively small they present difficulties of the first order for rock-climbers. It was there he laid the foundations of his great reputation, and he accomplished some great things in the Dolomites. His ambition was always to travel away from home and make the acquaintance of mountains of repute. Thus he traversed the Meije, ascended Mont Blanc from the Brenva Glacier, conquered the Grépon, and exhibited his prowess on several other of the great climbs. He was employed by Güssfeldt, Davidson, and Farrar,

all of whom placed him in the very first rank of guides. He seldom, if ever, refers to these and other people as his employers, but always as his friends, and they in turn regarded him as such, with the exception of one Russian prince with whom his relations were always strained owing to his aristocratic pretensions. Throughout his life Klucker always had many relatives dependent upon him, so that he found it difficult to provide for his old age. Being however a man of resource he became a very good lecturer, and was much employed as such in winter months. His employers, of whom very few can now remain alive, remember him with admiration. His only foreign adventure was to accompany Whymper in his somewhat mysterious journey to the Canadian Rockies, about which so little has been published. His book has been well translated and can be read with sustained interest by all lovers of the mountains. C. of A.

THE SOLDIER AND THE EMPIRE. By Captain F. P. Roe. *Aldershot and London: Gale and Polden* (1932). $7\frac{1}{2} \times 5$ *inches;* xxiv + 282 *pages; illustrations and maps.* 5*s*

This small volume gives a history of the development and consolidation of the British Empire. It is a book written for soldiers by a soldier, and hence deals with its subject from the military point of view. It is indeed a history of the part the Army played in forming the Empire, and a large proportion is devoted to the origin and exploits of various famous regiments. It is a veritable compendium of information, for the author deals not only with history but with geography too. As his historical account develops, and he is led to one part of the world after another, he devotes a chapter or two to a geographical and economic description of the particular Dominion which he has reached.

The history is temperately written and appears reliable, and it is enlivened with many an anecdote of military exploits. The descriptions of the physical characteristics, economic resources, people, and constitutions of the various Dominions are distinctly good. The final part includes a chapter on the Great War, as illustrating the protection of the Empire; and two on Imperial communications. There is a foreword by Sir Charles Harington. The book is profusely illustrated, a large proportion of the plates being in colour. There is a world-map at the end, to illustrate Empire communications. Two small criticisms may be made. The authorship of the pictures (some of them well known) from which the plates illustrating battles were made might have been given; and in a book dealing with the British Empire some small mention might have been made of the Colonies, many of which have seen stirring history.

The author is to be congratulated on having produced a readable and attractive volume, in which much information is condensed into a small space. It is a book that will delight boys; that will be of interest and real educative value to all soldiers; and which, in these days when the Army is somewhat at a discount and the younger generation are apt to forget what it has done, might with advantage be read by many others. E. M. J

THE MAGIC OF THE SWATCHWAYS: cameos of cruising in small yachts. By Maurice Griffiths. *London: Edward Arnold & Co.* 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 236 *pages; illustrations and charts* (by F. B. Harnack). 10*s* 6*d*

Mr. Maurice Griffiths has written a series of impressions of the charm of mud-crawling, as a deep-sea yachtsman would describe some of his 'Cameos of Cruising in a Small Yacht.' This book will be welcomed by those who can appreciate the absorbing interest of navigating the Thames Estuary with its maze of shoals and sandbanks, spits and swatchways.

The author can see colour in a mud flat and feel the mystery of the silence of

a tidal creek without being oppressed with the melancholy that made Crabbe give such a dismal setting to his poem 'Peter Grimes.' There are, it seems, two distinct types of yachtsmen, one who appears unable to withstand the urge to take great risks, another who knows the sea is a mistress of uncertain temper, and woos her with discretion. The reader will be able to form his own opinion in which class he would place the author when he reads the chapter on the "Voice of the Shingle," and has himself sailed into Orford Haven with a local pilot on board.

In "Enough to Try a Saint" we read of a "wild night, with roaring angry seas with their death-like blackness capped by a seething ghostly whiteness, the drenching, beating rain and the utter darkness that blotted out even our mast-head"; this is good descriptive prose; but the experience of such a night at sea could have been avoided by going into Dover instead of beating down Channel.

Again, in the chapter "With Juanita to the Other Side," there is a description of a passage from Ostend in which terrible weather was encountered. This was no more than would have been expected when "the glass had fallen 6½ tenths since the previous evening." We make this criticism as the author is the Editor of the *Yachting Monthly*, and should set a better example to the young.

Several passages in the "Enchantment of the Sands" seem strangely familiar to the reviewer. Orwell Beacon and Wakering Haven do not appear in Waghenaer's chart, although we can guess at their position; they are shown in a chart by Thos. Bowen. Any one who is interested in the former configuration of the Maplin Sands will find reproductions of old charts in an article in the *Mariner's Mirror* of 1 January 1930, where will also be found a description of the "Broom-way" and a discussion of the origin of the term "Maplin." However we turn over the last pages with regret, having enjoyed a real treat which recalled numerous similar episodes in our own wanderings in the same waters. H. M. E.

TÜRKÇE-INGILIZCE YENI LÛGAT—NEW TURKISH-ENGLISH Dictionary. By H. M. THOMSON. *Istanbul: Kanaat Kütüphanesi* 1932. 6×4 *inches;* 560 *pages.* 250 *kuruş*

This little dictionary, kindly presented to the Society by General Pertev Pasha, is the first we have seen printed in the new Latin characters, and is a very welcome acquisition; for the identification of a modern Turkish form in one of the old Arabic-script dictionaries often involves a wearisome search. A short guide to the pronunciation of the new letters would have been useful. It is difficult for the Western European to become reconciled to some of them, especially to the *c* (pronounced as English *j*) and the *ı* (*i* without a dot). He must remember that the latter is regarded as an entirely distinct letter from *i* (with a dot) which it follows in the alphabet. Similarly *ö* is distinct from *o* and *ü* from *u*, and of course *ç* (pronounced *ch*) from *c* and *ş* (pronounced *sh*) from *s*. But *â* and *û* are not regarded as distinct from *a* and *u*, nor is *ğ* from *g*. The new alphabet has apparently come to stay and we must accustom ourselves to it. J. H. R.

THE MONTHLY RECORD

LAKE FUNDUZI, NORTHERN TRANSVAAL

The Zoutpansberg range in the Northern Transvaal has not yet been surveyed, and is rather inaccessible. There have been some differences of opinion as to its origin, some investigators attributing its parallel ranges to faulting, others to the deep erosion of longitudinal valleys in an old plateau. Miss E. P. Janisch visited the range in 1931, and her notes on the origin of Lake Funduzi, a prominent feature of the range, are printed in the *Transactions* of the Geological Society of South Africa, 34, 1931. The lake lies in the upper valley of the Umtali river, some 50 miles east-north-east of Louis Trichardt. It is $2\frac{3}{8}$ miles long, and from one-quarter to half a mile wide, lying near the head of a south-west–north-east valley, the eastern end being blocked by a landslide. The northern side of the valley is much higher and steeper than the southern, rising in steps. In places at the edges the lake is 12 feet deep, but since it is sacred to the Bavenda, they will not permit dragging or sounding. At 55 feet above the present level there is a well-defined tree-line, below which bushes and grass grow to within 20 feet of the edge. There is evidence of considerable and recent variations of level, accompanied, according to native report, by rumblings and shakings. A study of the landslide and other features, including a fold mountain cut transversely across the fold, indicate that the valley lies along the plane of a strike fault, slightly oblique to the axis of an anticline.

NATURAL VEGETATION OF RIVER-VALLEYS

For the study of early settlement it is necessary first to establish the primitive natural condition of the particular region. The original state of one class has been in dispute, namely the bottoms of the river valleys in the woodland regions. This question, with regard to Germany, is examined by R. Gradmann in the *Zeitschrift* of the Berlin Geographical Society, Nr. 1/2, 1932. It is obvious that man has altered the appearance of rivers, especially of the slower flowing, where meanders have been cut out and swamps drained, while the rivers themselves have built up their beds and otherwise altered their courses. The controversy centres upon the condition of the land on either side of the river-bed. One school holds that this present meadow-land is primaeval, and owes little to the work of man. They maintain that the absence of trees is caused by the annual flooding of the land, and especially by the formation of ice during the winter. One of the botanical features of the problem is the constancy of the units which make up these meadow "associations." Large areas, not subjected to floods, are covered by precisely similar associations: this is explained by the annual cutting of these meadows, which would otherwise revert in the course of time to woodland. The other school, which is supported by Gradmann, argues that these latter meadows are the result of years of cropping. If their plant life is analysed botanically it is found that the components are suited to withstand the cutting to which they are subjected twice a year—in fact, what might be called a "selection by the scythe" has taken place. He then advances to the proposition: "no meadows without scything." If this is the case, it is argued that the botanically similar river-bottoms must be due to the work of man, and are not primaeval. He also shows that in instances where the land is flooded, trees are frequently found. Historical evidence also supports this view. In the great wooded tracts of Germany, not far removed from populous areas, no prehistoric settlements are found in the river-bottoms. The Roman roads generally kept to the waterpartings. In other parts of the world similar evidence may be found. There is, he claims, nothing

in the accounts of early travellers in North America to suggest that natural clearings or "meadows" existed in the forests, but it seems doubtful if this argument holds good of all woodlands.

THE CHART-MAKER LOPO HOMEM

In noticing (May *Journal*, p. 447) a publication by Professor Crinò which dealt chiefly with the work of the Homem family we referred to his acceptance of the view, first suggested in the *Journal* for March 1931, that there must have been two members of it bearing the name Lopo. This has brought a communication from Professor Caraci (by whom, it will be remembered, Lopo's map of 1519 was denounced as a forgery) setting forth reasons for believing that there was only one cartographer of that name. It may at once be conceded that he makes out a good case for the latter view, according to which the Portuguese Royal Cartographer of the second decade of the sixteenth century was the same as the man who produced the large world-map of 1554, now at Florence. He is supported in this by the Portuguese writer, Dr. A. Cortesão, who informs us that he too is convinced that there was only one Lopo who made maps. But while the contrary suggestion was made in the *Journal* we have never insisted on it as certainly correct, and the case for the genuineness of the 1519 map in no way depended on its acceptance. In his present communication Sig. Caraci keeps this, the main point in question, in the background, and concentrates attention on the minor issue. He seems also to betray some misunderstanding of his opponents' views, but though his paper is too long to print in full, its main points may be summarized.

There are documents bearing on the personality and work of Lopo Homem dated 1524, 1530, 1541, 1547, and 1554. The first refers to one of seven years earlier, so that we know of Lopo's activity from 1517, when he received from King Emanuel the licence to make and correct all the "agulhas de marear"—nautical instruments: nautical charts, the making of which was a distinct function, are not yet mentioned. The 1530 document is known to Sig. Caraci only through Dr. Cortesão, so he passes on to that of 1541. This shows us Lopo before the Holy Office, still alive and vigorous, for he had lately gone to amuse himself at Santos with one Alvaro Fernandez, a maker of instruments. It states that he "faz cartas de marear," so there is every reason to identify him with the Royal cartographer. In an act dated 1547 King John III grants pardon to Diego Homem, involved in a charge of murder, who is stated to be son of Lopo and to have learned "sua ciencia de cosmografia e arte de navegar" for the service of the Crown, while his father is spoken of as "cavaleiro" of the Royal house, a dignity also claimed by the author of the 1554 map. In all this there is certainly no suggestion of two Lopos, even though the demonstration of unity is not quite so absolute as Sig. Caraci contends.

Some attention is also given to the question of Lopo's age, on which the supporters of the other view laid some stress. The document of 1547 (referring to a crime committed before 1545) shows Diego to us as then living in England as cartographer, so that he would probably be not less than thirty-five to forty years old, particularly if, as Winsor thought, he had already produced an atlas or chart in 1530. Sig. Caraci's calculations appear somewhat confused, but if we allow an interval of twenty-five years between the ages of father and son Lopo would have been born about 1480–85 (Sig. Caraci, by an apparent slip, puts him about twenty at that time) and would be old enough to receive the Royal privilege in 1517. But we are puzzled by the further suggestion of Lopos of two previous generations, the elder of whom, it is said, would have been from seventy-two to seventy-seven in 1517. No one has yet supposed a bearer of the name previous

to the father of Diego, recognized as author of the 1519 map, the holders of the two-Lopo theory having merely suggested that one of a younger generation might have borne the name Lopo, and been responsible for the map of 1554.

As already pointed out, Sig. Caraci has adduced no new arguments to support his original accusation of forgery in respect of the 1519 map, the genuineness of which is fully allowed by Dr. Cortesão. This writer is engaged on a work on Portuguese cartography, the appearance of which will be awaited with interest.

We take this opportunity of correcting a mistake unfortunately made in our previous note. Professor Crinò's reproduction of the 1554 map is on a smaller, not larger, scale than Sig. Caraci's. The latter also criticizes the statement that the undated specimen of Lopo's work had been lost to sight in recent years. Its whereabouts, he says, was well known to himself and to others, but it is none the less true that it had been the subject of no up-to-date commentary, and was therefore little known to students outside Italy. Sig. Caraci puts its date between 1535 and 1551.

EARLY ITALIAN MAP OF ETHIOPIA

One of the finest known Ptolemy MSS. of the fifteenth century is that written by the French illuminator Hugues Commineau, with maps drawn by an Italian of Florence, Pietro del Massajo ("Massarius"). In recording the acquisition of a photographic reproduction of its maps (*G.J.* Supplement No. 25, p. 34) attention was called to the non-Ptolemaic maps included in the codex and especially a remarkable map of North-East Africa. This has now been separately reproduced, with suitable commentary, as the first part of a new series issued under the editorship of Professor Almagià by the Geographical Institute of the University of Rome, 1932. Curiously enough, both the general editor and the writer of the commentary, Dr. Laura Mannoni, speak of the map as "now reproduced for the first time," although a footnote by the latter (possibly added when going to press) refers to the earlier reproduction and gives the numbers of the sheets on which it is there printed. But Dr. Mannoni's notes are of much interest, and give just the information needed to understand the history and content of the map. It embraces both Egypt and a part of the Upper Nile basin corresponding in the main to Abyssinia. While the former part does little but reproduce the old Ptolemaic model the latter shows a surprising amount of definite knowledge, the river-systems, particularly those of the Blue Nile, Takkaze and Awash, being drawn with fair accuracy. A large number of place-names are inserted, mostly in regular series, which show that they were probably derived from itineraries, some of which follow the river-courses. Lake Tana and its islands appear in unmistakable form, and the lake receives the name Sahaf, which reappears in so many subsequent documents (cf. *Journal*, vol. 47, p. 305). The name "Abia" appears, but is given not to the main course of the Blue Nile but to an affluent. The Takkaze and Awash are both named in slightly variant form, as also the Mena, an affluent of the former. Among the other names we find those of districts like Maria, Serae, Tigre, Begemeder (as "Mogmeder"), Damot, Fatagar, Woghera; the noted convent of Lelia ("Alleluia"); and many of individual places, of which not all can be identified. A well-marked itinerary, which must have been one in common use, leads from the Takkaze to Lake Tana. It is known that the codex was sold in 1456 by a merchant of Florence to Alfonso of Aragon, King of Naples, and the map is therefore the earliest known source for the detailed topography of this region, being slightly earlier than the equally detailed version of Fra Mauro (usually dated 1459, though put down as 1460 in the text). The two versions show little resemblance, and evidently represent

the knowledge possessed at the time at Florence and Venice respectively. In both cases it must have been obtained from those who had actual knowledge of the country, and Dr. Mannoni suggests that the Florentine version may have been obtained from the Abyssinian envoys who visited Florence in 1441, as mentioned, among others, by Flavio Biondo, who interviewed them himself.

THE EARLIEST GEODETIC TRIANGULATION

Willebrord Snel van Roien, born at Leiden in 1580, is known as the first to attempt to measure the size of the Earth with modern scientific precision. The scheme of triangulation which he carried out for this purpose is described in his rare 'Eratosthenes Batavus,' 1617. This contains a general map of the stations only. Attempts to reconstruct a triangulation diagram from his data have been made from time to time, but none is entirely satisfactory. The subject has recently been investigated by the Rev. A. J. Potter, in a paper, illustrated by a page diagram, in the *Empire Survey Review*, January 1932. The author is careful to emphasize that Snel's was the earliest geodetic triangulation, for triangulation had been carried out previously by Gemma Frisius and William Bourne, among others. Snel calculated the length of a degree along the meridian for two cases, obtaining the result 28,510 (Rhineland) rods and 28,473 rods. Defects in astronomical observations and calculation caused the discordance in the final results, which seems so to have disturbed Snel as to contribute to his early death. It is shown however that the results were actually much better than he suspected, or many have since recognized. The network by which he obtained his meridian distances is very warmly praised. Some mistakes have been detected: a descendant, Musschenbroek, showed that in sighting back to Leiden from Dordrecht and Utrecht, Snel mistook other towers for that of the Stadhuis, involving three mistakes of about 17′ each, though since one "shot" was 27 miles, this is hardly to be wondered at. The author gives a table comparing the true values with Snel's results, after necessary corrections. This brings out a greater discrepancy between the results in the two cases than appeared from the original values, and a mean (29,608·1 rods) which exceeds the true value by about 1 in 700—though one of the triangles is much more accurate. It is anticipated however that the elimination of further discrepancies would bring the accordance of Snel's figures with one another and with the true values to well within 1 in 1000—the uncertainty as to the length of the rod. As Snel made no use of logarithms (though Napier invented his system three years before the publication of 'Eratosthenes Batavus') the amount of arithmetical calculation involved must have been enormous, and it is no wonder that mistakes crept in, while some seem to have been introduced by the printer. But such errors are trifles compared with the greatness of his achievement, which compels admiration for his genius.

COLLECTION OF CADASTRAL SURVEY AND LAND RECORDS

At the instance of the Secretary of State for the Colonies the Society has arranged to house the specimen cadastral survey, land registry, and land revenue records which were exhibited at the Science Museum last July upon the occasion of the second Conference of Empire Surveyors. This is in execution of the wish expressed by the Conference that the exhibits should be retained in some appropriate centre in London, as the nucleus of a permanent collection for reference and study.

With this object in view it is hoped gradually to supplement the original exhibits and build up a really comprehensive and representative collection gathered from all parts of the world and exemplifying work of this nature carried

out under all sorts of conditions and to meet all sorts of needs. It is intended that the collection shall include land laws, regulations, and technical instructions, and that as it grows it shall also be kept representative of, and abreast with, progressive advances in cadastral survey and land records in each country.

No funds are available for the purpose, and so success in attaining the objects arrived at must depend upon the systematic co-operation of the Survey and Land services everywhere, coupled with the very valuable help that those who have been personally concerned with the conduct of such work in various parts of the world may be able and willing to give. Sir Ernest Dowson and Mr. V. L. O. Sheppard have jointly undertaken the collection, study, and maintenance of the documents. As soon as the millboard covers that are needed to preserve them have been supplied the specimen maps and records will be available for consultation at any time during the Society's working hours upon application in the Map Room. But Sir Ernest Dowson and Mr. Sheppard will only be able to visit the Society's House fortnightly or by special arrangement, and will do most of the necessary work in their own homes. Those interested, or in a position to assist, are accordingly requested to communicate with them at their private addresses, which are respectively: Bowyers Field, Wrotham, Kent, and Gordon Lodge, Kemble, near Cirencester, Gloucestershire. Rolls of maps or other bulky parcels should however be sent to them to the care of the Society. E. D.

EXPEDITION TO NORTHEAST LAND

Mr. H. W. Ahlmann contributes a short summary of the Swedish-Norwegian expedition, which he led to Northeast Land last summer, to the *Annales de Géographie*, March 1932. The expedition received extensive support, notably from the Swedish and Norwegian Governments, and from the Swedish Geographical Society. Its objects were to study the continental glaciers, the geology of the so-called Hecla Hoek formation, and the flora, and to carry out meteorological and oceanographical observations. Thanks to a mild winter, the expedition was able to leave on the *Quest* on June 15, and nine days later to establish a base at Murchison Bay. A small party landed at Wahlenberg Bay, and made a sledge journey of sixteen days through the interior practically to the east coast, returning to the base. The *Quest* meanwhile proceeded to Francis Joseph Land, circumnavigated Alexandra Land, and returned north of Northeast Land to Murchison Bay. During this voyage 103 oceanographical stations were occupied, and these observations on the régime at the extreme limit of the Gulf Stream promise interesting results.

The observations of the sledge party show that there are three distinct ice-fields in the interior, and not one large ice-cap as was supposed. The ice is almost entirely augmented by frost action, and at present the glacier fronts are in a state of equilibrium. Proofs of a vast glaciation of Cambrian age were also obtained. During the course of the expedition various members carried out photogrammetric surveys, at Wahlenberg Bay, Cape Mohn, and elsewhere, and determined the position of several islands, including Moffen and Foyn Islands. A preliminary topographical sketch-map of Northeast Land accompanies the article.

LIVERPOOL TIDAL INSTITUTE

We have received from the Director, Dr. J. Proudman, a copy of the Annual Report for 1931 of the Liverpool Observatory and Tidal Institute. It contains a summary of the research work done by members of the staff, principally in tidal dynamics, in addition to the usual routine. During the year seventy-five sets of tidal predictions were prepared for authorities in many parts of the world, and meteorological information has been supplied to the Harbour Board, public

officers, and firms. It is noted that the rainfall for the year was substantially above the average: the fall for June was 222 per cent. of the normal, while that for March was 14 per cent. of the normal only.

DEATH OF ADMIRAL CAGNI

We record with great regret the death of Admiral Umberto Cagni, at the age of sixty-nine. The Admiral took part in two expeditions led by the Duke of the Abruzzi—the ascent of Mount St. Elias, 1897, and the *Stella Polare* Arctic Expedition of 1899–1900. On this expedition, Cagni was second-in-command, and in charge of the scientific observations. The *Stella Polare*, it will be remembered, wintered in Teplitz Bay, Prince Rudolf Island, one of the Franz Josef Archipelago. Through frost-bite the Duke was obliged to yield the command of the proposed sledge journey to the Pole to Cagni. After a false start, Cagni set out on 11 March 1900 with nine companions. The first supporting party was never again heard of after leaving him; the second left him on March 31, when he pushed on with three companions—two Alpine guides and a sailor—and forty-eight dogs. Despite bad weather conditions at the outset, the party succeeded in reaching, on April 25, 86° 34′ N.—thus establishing a "farthest north" record. The return journey was exceedingly arduous—through the westerly drift of the ice, and it was with a very small margin to spare that they reached Harley Island on June 13 and Prince Rudolf Island ten days later, having travelled 753 miles. When the Duke of the Abruzzi received the Royal Medal, in 1901, Admiral Cagni was awarded the Gill Memorial.

THE WINELAND VOYAGES

We have received from Newfoundland a copy of a pamphlet on the Wineland voyages, written by Mr. W. A. Munn. It can hardly be regarded as an important contribution to the extensive literature on the subject. Mr. Munn patriotically locates Leif's landfall in his own country, the spot chosen being Pistolet Bay, in the northern peninsula of Newfoundland. Though he claims to speak with dogmatic confidence, his rather naïve pamphlet displays no indications of the scholarship necessary for a proper appreciation of the evidence, which is only made to fit the author's theory by a process of distinctly arbitrary selection. The 'Studier over Vinlandsreiserne' of the late Dr. Gustav Storm, quaintly referred to as "Gustavus Storm, the noted historian of Copenhagen, in his 'Memories of the Society Royale Antiquities of the North' (*sic*)," do not, as Mr. Munn seems to believe, in any way support his interpretation of the crucial "eyktarstad" passage

G. M. G.-H.

OBITUARY

W. H. ARDEN WOOD

The death of W. H. Arden Wood, at the age of seventy-four, removes a well-known and much respected figure in Indian educational circles, and one of the greatest authorities on the geography of the Indian Empire. Arden Wood went up to Christ Church from Manchester Grammar School, and after a short period of teaching in England joined the staff of La Martinière College, Calcutta, in 1885. With the exception of a short period of three years he served that Institution until 1920, when he retired from the Principalship which he had held since 1892. La Martinière owes him a debt which cannot be expressed in words. But Arden Wood by no means confined his interests to the school and its pupils. He was a member of the Syndicate of the University of Calcutta, and as long ago as 1908 secured the introduction of geography into its curriculum. He also found time for many civic duties and was a member of the Bengal Legislative Council during his last four years in India. For his services to education and to the state he was made an Honorary Fellow of Calcutta University and a Companion of the Order of the Indian Empire. After his retirement he continued to work for India as Honorary Secretary of the European Schools in India Association.

Arden Wood had a profound knowledge of Indian geography and there was scarcely an aspect of it which he had not studied thoroughly. A fragment of his knowledge was published in 'A Short Geography of Bengal' (1895), and in papers and reviews—many of the latter in the *Journal*. He had long been accumulating material for an advanced geographical study of India and was actively engaged in its arrangement when he died. It is to be hoped that some at least of his wide knowledge may yet be made available for others. J. N. L. B.

MEETINGS: SESSION 1931–1932

Fourteenth Evening Meeting, 23 May 1932. The President in the Chair

Elections: Isaac B. Bateman, J.P.; Reginald A. Bennett, O.B.E.; Captain Osmonde Hedworth Farrar, O.B.E., A.M.I.N.A.; Richard Finnie; Linley V. Gordon; Paul E. Gregson; Captain F. W. Haswell, I.A.; Philip Edward Gibbs Holtom; George H. T. Kimble, M.A.; Murari Lal, B.A.; Cyril Albert Lane; W. L. D. Martyn; Miss Emma Gordon Miller; Miss Winifred Norah Miller; John Llewellyn Turner; William Lambert Whalley

Paper: Across the Rub' al Khali to Ubar. By Mr. H. StJ. B. Philby

Fifteenth Evening Meeting, 6 June 1932. The President in the Chair

Elections: E. G. Beresford, B.A.; Col. Lloyd Vernon Briggs; Paul Ryeaut de Shordiche Churchward; Mrs. Emmeline Cust; Horace Warnes Cushing, B.A.; Miss Marion L. Darby; Miss Deacon; Gaverick Austin Farmar; Prescott H. F. Follett; Kenneth N. G. Foster; Frederick Ronald Gardner, B.SC ; Alec A. Golding, B.SC.; Jacques Achille Gonat; Colonel Frederick Arthur Hamilton; Miss Margaret Higford; Norman Gordon Hodson, B.A.; Mrs. Edith Traill Hoth; Herbert D. Leigh; Eann Alister Macdonald; F. Pelham Maitland; Lt.-Col. Reginald George Munn, C.M.G.; George Muir Philip; Evan David Reynolds; John Gibson Roberts; Kenard Henry Seacome; San Shwe, M.A.; Joseph Eric Smith, B.A.; James William Starkey, B.SC.; Charles Lambré Stewart; Sir Campbell Stuart, K.B.E.; John Cuming Walters, M.A.; Alfred Samuel Ward-Woodger; Captain Frank Willard

Paper: Ngamiland and the Kalahari. By Mr. C. F. Rey

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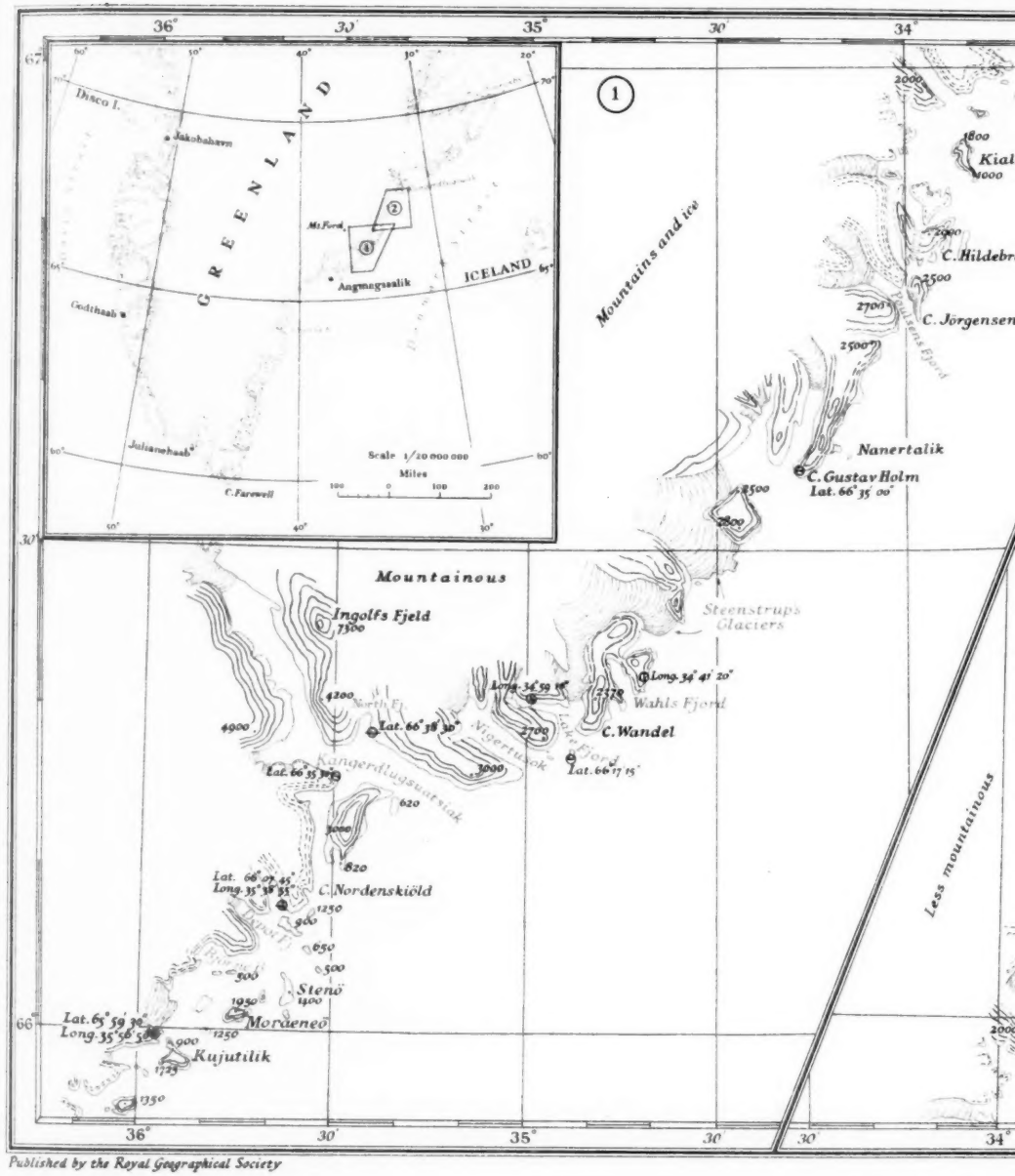

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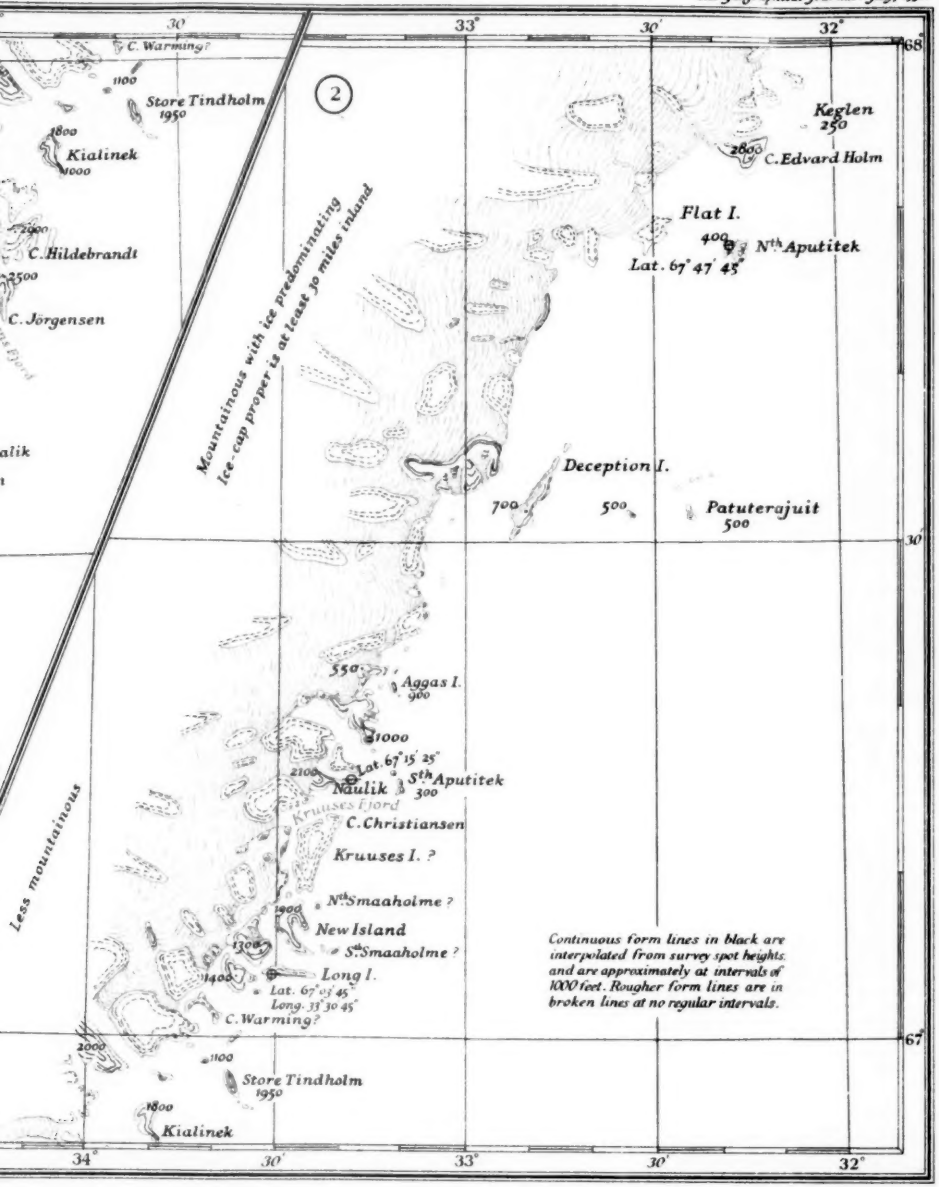

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British Arctic Air Route Expedition

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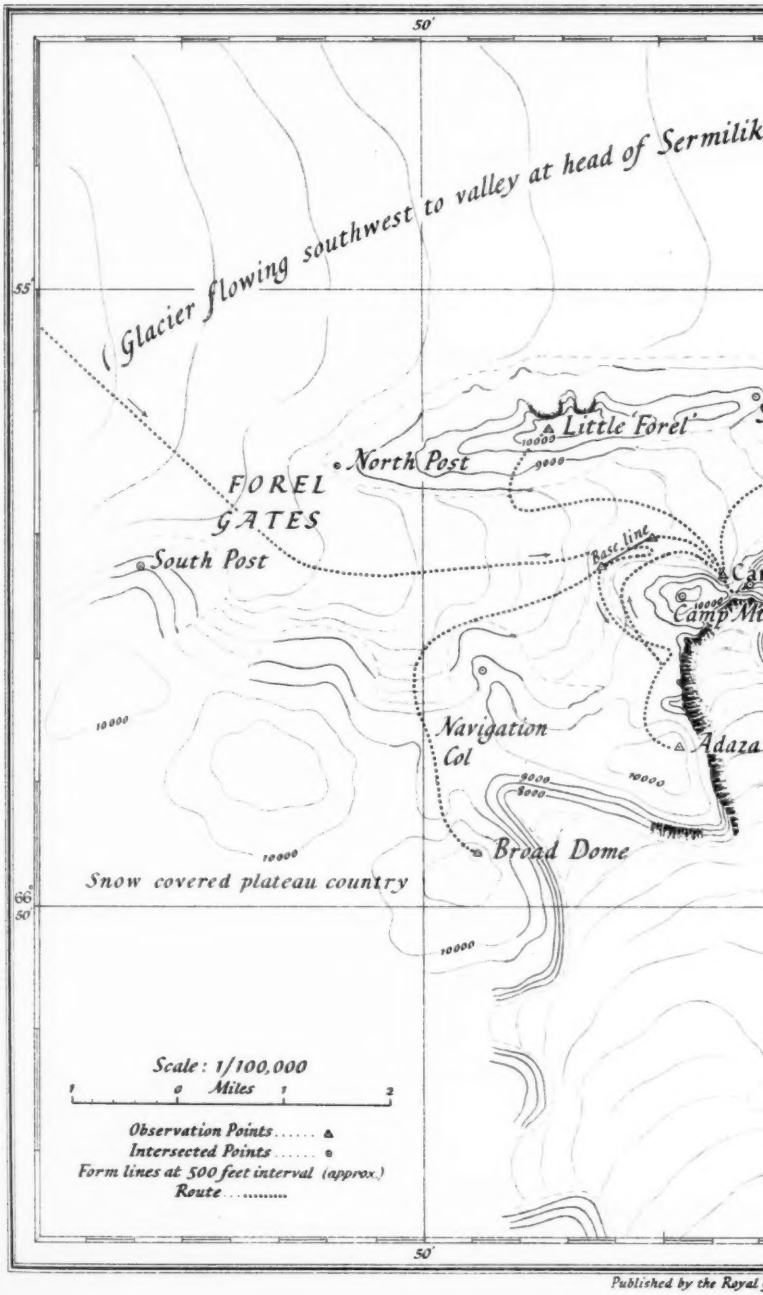

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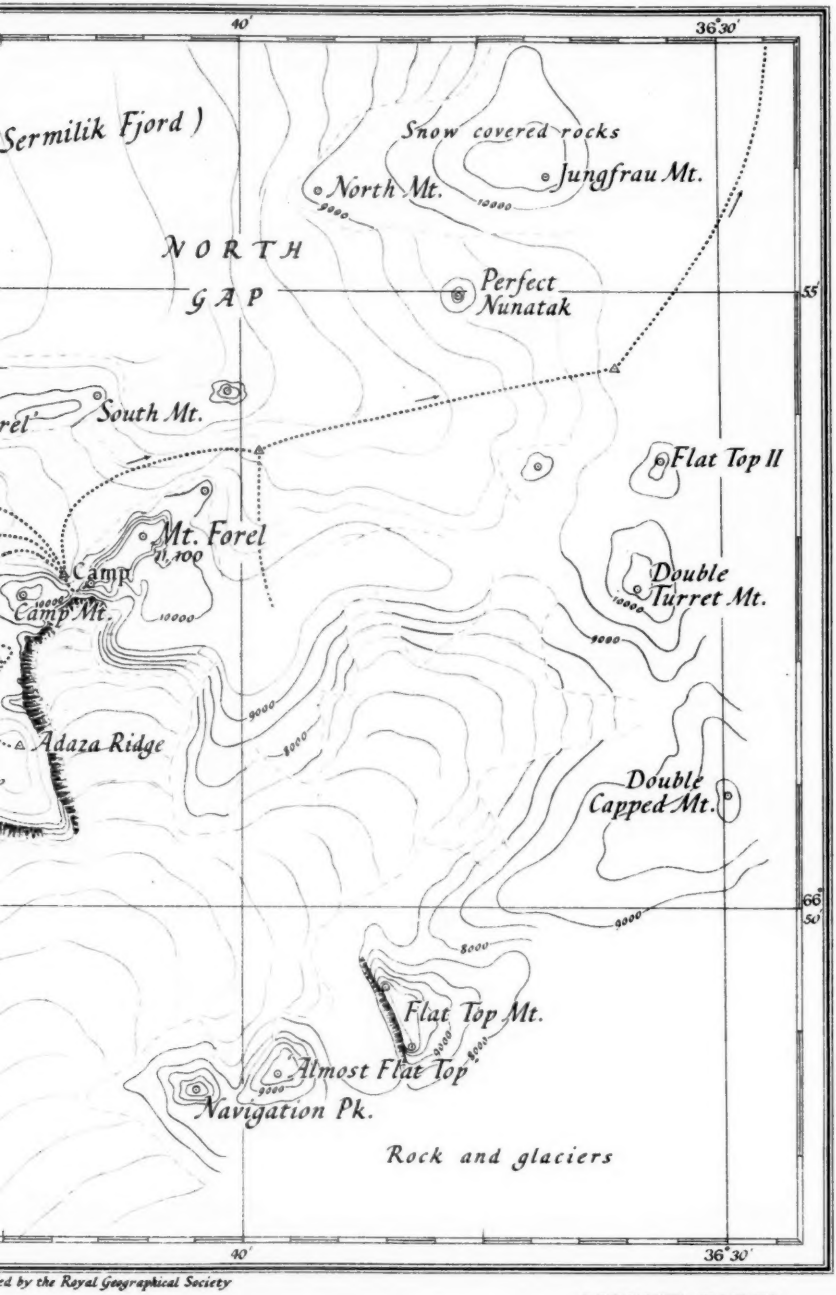

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